



RICE ENVIRONMENTAL INSTITUTE

TASK FORCE REPORT_FINAL_AUGUST, 2022

EXECUTIVE SUMMARY

1.0. INTRO: RICE'S POTENTIAL

2.0. WHY AN INSTITUTE?

3.0. ENVIRONMENTAL RESEARCH

- 3.1. Existing Strengths
- 3.2. Research Needs
- 3.3. Proposed Structure
- 3.4. Rice's Opportunity

4.0. ENVIRONMENTAL EDUCATION

- 4.1. Enhancing Core Strengths
- 4.2. New Initiatives

5.0. ENVIRONMENTAL ENGAGEMENT

- 5.1. University Engagement
- 5.2. Community Engagement
- 5.3. Civic Engagement
- 5.4. Industry Engagement
- 5.5. National Engagement

6.0. STRUCTURE AND NEXT STEPS

- 6.1. Institute Design
- 6.2. Research: Next Steps
- 6.3. Education: Next Steps
- 6.4. Engagement: Next Steps



2021 HANSZEN COLLEGE CLT FRAMING

PREFACE

This document lays out recommendations for the development of an environmental institute at Rice. It was prepared by an 8-person task force co-chaired by Albert Pope (Architecture; Kinder Institute) and Caroline Masiello (Earth, Environmental and Planetary Sciences; director, Environmental Science major) with Lydia Beaudrot (Biosciences; Data Science Program), Joseph Campana (English; co-director, Environmental Studies minor), Daniel Cohan (Civil and Environmental Engineering, Baker Institute), Sylvia Dee (Earth, Environmental and Planetary Sciences), Ted Loch-Temzelides (Economics, Baker Institute) and Laurence Yeung (Earth, Environmental and Planetary Sciences). Committee members were selected by Vice Provost of Research Yousif Shamoo to represent a breadth of disciplinary stakeholders in the university's environmental scholarship.

TIDWELL ROAD FROM SAM HOUSTON TOLLWAY LOOKING EAST, AUGUST 28, 2017.

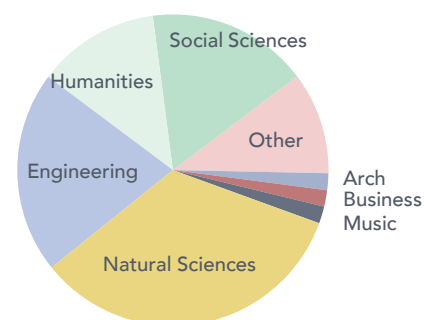


While they were invited to serve as representatives of their schools, members were also charged with considering how the University as a whole can respond to the needs and opportunities that global environmental challenges present. The committee met with over 100 faculty and with the deans of the schools of Natural Sciences, Engineering, Humanities, Social Sciences, and Architecture to determine Rice's environmental research areas of strength, and where greater capability is needed. The task force met in person on eight occasions in the Fall of 2019 and the Spring of 2020, and continued to meet virtually after the university temporarily closed in Spring 2020 due to COVID-19.

In the course of preparing this document the task force engaged with a grassroots group of ~140 campus scholars who self-identified as having an environmental component to their research ("Envirofac"). The breadth of membership in this group is extraordinary, including scholars from 24 departments and 7 institutes, programs, and centers (see figure). There were many faculty participants representing the departments historically strong in environmental scholarship (e.g. Anthropology, Architecture, Biosciences, Civil & Environmental Engineering, English, Earth, Environmental & Planetary Sciences, Sociology). In addition, colleagues self-identified as environmental scholars in programs as diverse as business, Kinesiology, Music, Religion, Spanish, Portuguese & Latin American Studies, and Statistics. The task force held multiple town-hall style meetings with this group of researchers, which served as workshops for the development of the main ideas presented in this document. This document focuses the diversity of Rice's environmental expertise into a proposal to create an institute to act as an accelerator for extraordinary environmental scholarship, education, and development of real-world solutions.

This document first lays out a case for the timeliness of Rice's choice to deepen its investment in environmental scholarship now. It then makes the case that Rice is well-placed to engage in the critical work necessary to address many key environmental challenges. Then the proposal outlines key principles for defining Rice's activities in the area of environment going forward. These design principles describe the structure of how the University could construct a "hub and spokes" model of an institute unlike any other structure presently at Rice. The body of the report lays out plans for structuring research, education, and community engagement within an environmental institute. It concludes with concrete next steps that can be taken to move forward.

ENVIROFAC MEMBER DISTRIBUTION





The draft of this report circulated in the summer and fall of 2020 to central administration, deans and department chairs, receiving feedback at all levels. With the dissolution of the task force, the Envirofac Steering Committee (including several original task force members but also new members Dominic Boyer, James Doss Gollin, Gisela Heffes, Richard Johnson, Dan Kowal, Lisa Spiro and Anna Rhodes) has stepped in to incorporate this feedback into this revised and updated report. Much has happened in the past two years including notably the launch of the Ion innovation hub, the landmark \$1.1 billion gift to Stanford to fund the Doerr School of Sustainability and the February 11, 2022 message to the campus community from President Leebron and Provost DesRoches announcing a new “commitment to sustainability as an overarching policy that spans all facets of the university’s actions.” Founding the Rice Environmental Institute will accelerate Rice’s ability to meet its new sustainability commitments.

EXECUTIVE SUMMARY

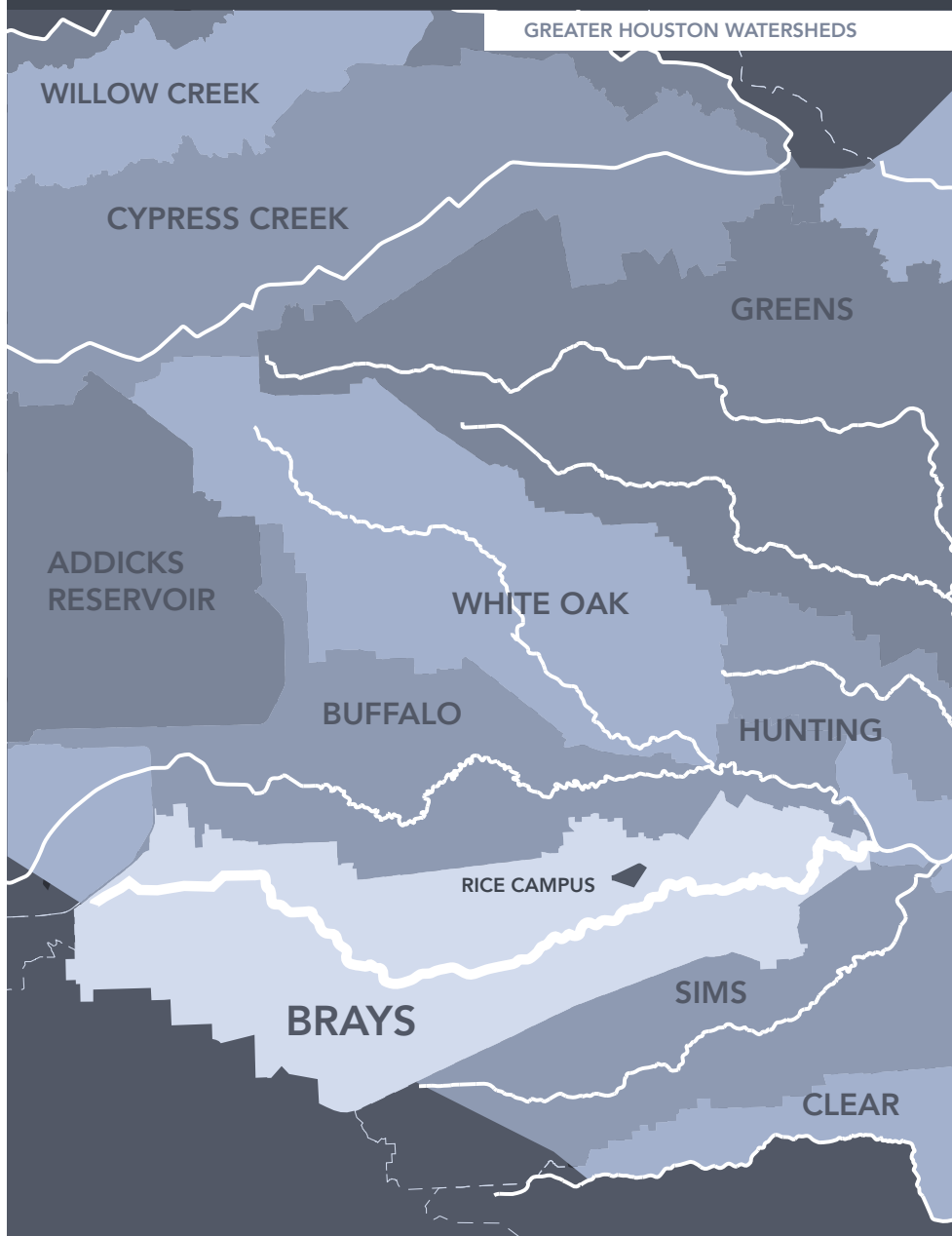
Our current environmental crises are historically unique in terms of their scale, complexity and threat to humanity. What were simply disturbing climate model predictions 20 years ago are now increasingly our reality as we move into a world where our weather is not just hotter, but also characterized by more frequent hydrologic extremes of drought and flooding. These extreme events intersect with growth in human population, triggering the unfortunately predictable consequences of food and water insecurity, which themselves lead to social instability from rapid changes in communities’ migration patterns.

Climate change is an accelerant for other environmental problems like biodiversity loss, which itself feeds into social and health challenges. Use of natural resources becomes increasingly unstable as ecosystems shift in response to climate change, triggering social and cultural conflict. Similarly, our intrusion into previously-intact landscapes has led to the increased transfer of zoonotic disease, a problem which we are all now well-aware of in 2022.

Our 21st century environmental problems are both urgent and fundamentally multidisciplinary. This requires universities to carefully consider their role in accelerating discoveries and novel technologies, as well as in providing expertise and partnerships to help our communities make the necessary adaptations to our changing environment. Rice is particularly strong in many of the underlying disciplines needed to both innovate and adapt. Successfully marshaling and expanding our excellent academic resources will require a highly interdisciplinary approach based on a systems-level view of how the atmosphere, hydrosphere and biosphere interact both with each other and with the human systems that rely on them. This requires not only science, but also an accounting of the human and societal conditions and values that go with it.

Many of Rice's peer institutions — including Stanford, MIT, Duke, Yale, Princeton, Johns Hopkins, Berkeley and Michigan — have successfully attracted donations of between \$10 million and \$1 billion to support environment and sustainability initiatives. Rice is well-poised to advance its existing leadership and make a fresh commitment to address both the challenges and opportunities that our environmental challenges present. It has an outstanding foundation of faculty research, educational expertise and community outreach upon which to build a multidisciplinary Institute of the Environment. We support the approach outlined by university leadership in their Feb 11, 2022 email to position "investments in the environment as one of the university's highest funding priorities." These investments will reinforce and elevate the ability of Rice faculty to win competitive external grants; indeed, members of the Rice Environmental Initiative have collectively raised over 150 million dollars over the last 5 years.

To this end, we propose that Rice commits to creating the Rice Environmental Institute. We project this as a roughly \$50 million investment including funding for new faculty lines in key interdisciplinary opportunity areas, administrative support, physical space, and seed funding for research and teaching innovation.



THE RICE ENVIRONMENTAL INSTITUTE WILL IDENTIFY, UNDERSTAND, AND ADDRESS THE UNIVERSITY'S ENVIRONMENTAL EFFORTS IN THREE BASIC AREAS: RESEARCH, EDUCATION AND ENGAGEMENT.

RESEARCH. Human activities are driving rapid changes to climate, biodiversity, and natural resources with cascading, worldwide effects. We must evaluate how human activities affect both natural and built environments, and how research can foster lasting solutions to emerging environmental challenges. The Rice Environmental Institute will build environmental knowledge and solutions by catalyzing transformative, interdisciplinary excellence among all seven schools at Rice.

EDUCATION. Graduates who can tackle the challenges and opportunities arising from local and global environmental change will be leaders as communities respond. The Rice Environmental Institute will bring a comprehensive approach to environmental education, balancing natural and human elements and providing real-world experience linking knowledge to action.

ENGAGEMENT. Practical solutions to environmental challenges come from partnerships with governments, non-profit organizations, businesses and community stakeholders at local, national, and global scales. The Rice Environmental Institute will create a nexus for these partnerships, promoting sound, responsive, and equitable environmental policies and practices in an increasingly interconnected global landscape.

HOUSTON. Houston embodies key dimensions of humanity's future. One-third of the world's population lives, like Houstonians, on the coast, where environmental change, economic development, and human ingenuity will all collide in the coming century. While scholars at The Rice Environmental Institute will pursue challenges across the globe, the institute will promote the use of Houston as a site for testing solutions.

1.0 RICE'S POTENTIAL TO MEET 21ST CENTURY ENVIRONMENTAL CHALLENGES

Universities are crucial to solving the 21st century's environmental problems, including problems like climate change, biodiversity loss, water scarcity, and pollution from poorly managed industries. Academic institutions bring unique research capabilities across a breadth of relevant subject areas needed to understand scientific human implications of environmental changes. In a world in which the public dialogue about environmental problems is rife with hyperbole, exaggeration, and rhetoric, universities bring the credibility, independence, and objectivity needed to inform, explain, and improve public understanding of what the future holds and how society should adapt. Universities also play a critical role in educating future generations of leaders. To address environmental challenges with necessary urgency, a university must also have deep capabilities in areas not traditionally seen as academic strengths, including communicating to broad audiences; partnering with communities, policymakers, and leaders of private industry; and developing feasible and pragmatic solutions.

The intellectual resources of the academic world need to be marshaled and expanded in ways proportional to the gravity of this situation. Universities need to consider if they can generate this new kind of intellectual power. Such an existential challenge demands the attention of Rice in particular, given its location at the center of the carbon economy, its extraordinary resources, and its strength in many of the underlying disciplines. Given this foundation, Rice is well-poised to advance its existing leadership and make a bold commitment to address our



MEMORIAL PARK, BAYOU ECOSYSTEM

environmental challenges.

Environmental challenges are inherently multidisciplinary. The environmental challenges of the 21st century are at their core scientific problems driven by human activities. This makes them fundamentally multidisciplinary and multi-stakeholder, features that make finding effective solutions challenging. Traditional single-discipline approaches to environmental problems are almost universally unsuccessful because they miss the perspectives (and therefore needs) of all relevant stakeholders. Universities have the potential to act as incubators for real, workable environmental solutions because they house scholars with the breadth of necessary disciplinary skills to address the needs of all stakeholders, but not all universities have a history of the interdisciplinary conversations and extramural relationships necessary to generate successful environmental solutions. Rice is one of few institutions well-positioned to create these solutions because of our historic successes in multidisciplinary problem-solving and our long-term, effective relationships with environmental stakeholders ranging from biodiversity NGOs, to governments, to energy companies.

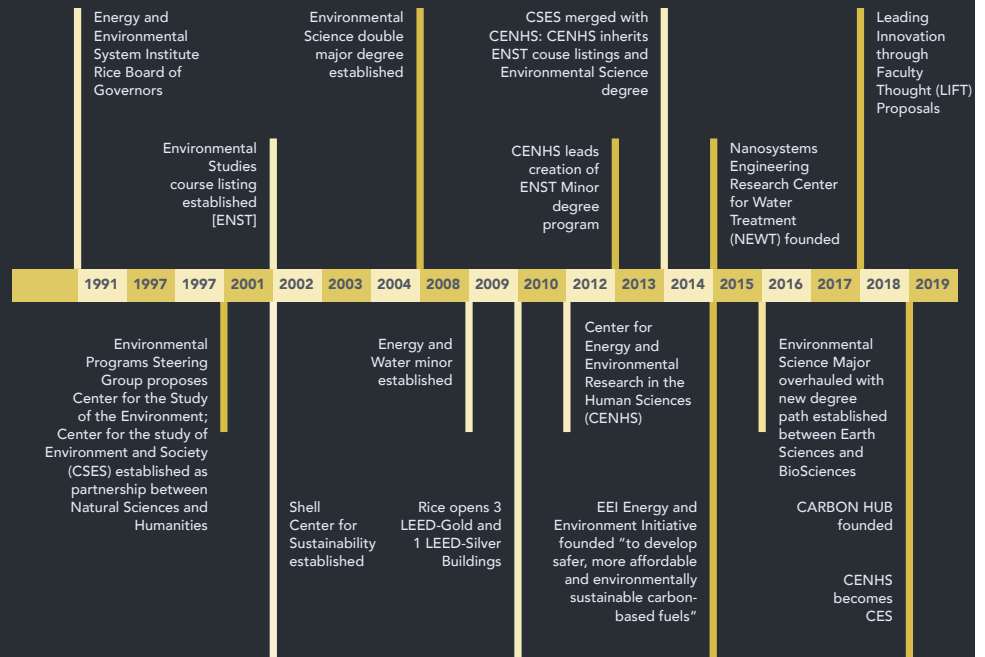
The Rice community is ready to accelerate our engagement in environmental research, teaching, and community engagement. Members of our greater Rice community - students, alumni, faculty, and our Texas community - are increasingly looking to us to train a generation of problem-solvers with the skills needed to construct durable, flexible environmental solutions. Rice is not alone in receiving this message from university stakeholders: our peer institutions are under similar pressure to use their latent skills in building environmental institutes as well, with more than 75% of our AAU peers already investing in stand-alone environmental research institutes. As noted by a recent report funded by the Cynthia and George Mitchell Foundation (Hoffman and Axon, 2017), "universities are experimenting with new types of organizational centers and institutes to make the sum of diverse activities greater than the individual parts." In the area of the environment, Rice is well-positioned to create this "better sum."

Our students, faculty, and alumni are making it clear that Rice urgently needs to strengthen our role in accelerating the discoveries and novel technologies needed to resolve environmental challenges. We are also called to provide expertise and partnerships to cities, states, and countries who must make the necessary adaptations to our changing environment. Rice is particularly strong in many of the underlying disciplines needed to innovate, adapt, and provide guidance. To focus and strengthen our impact, Rice must marshal and expand these and other powerful academic resources. A transdisciplinary approach is needed based on a systems-level view of how the atmosphere, hydrosphere, geosphere and biosphere interact both with each other and with vast, human-made systems that rely on them. This requires not only science, but an accounting of the human and societal conditions and values that go with it. Science and social science should feed into policies just as the issues that are addressed and the solutions that are proffered should be informed by the real problems on the ground. While these

WHY RICE, WHY THE ENVIRONMENT?

Rice's balance between exceptional undergraduate education and first-rate research positions us to offer authentic, inquiry-based education that enables our students to envision and implement creative, interdisciplinary solutions. Houston's location as a rapidly-growing and extraordinarily diverse city of national and global import, and as a nexus of global commerce, transport, and energy located in the humid subtropics means that we exhibit or find ourselves closely connected to an extraordinary range of representative environmental problems. Rice has significant depth and breadth in environmental research already, with almost every department housing multiple faculty who consider this their primary research area. Very few other topics are intermeshed within Rice's teaching and research as deeply as the environment. However, taking advantage of this depth and breadth is also a great challenge, as it requires coordinating across at least 5 schools as well as cross-disciplinary institutes at the university. Our education-focused approach begins in a place where other Rice environment-related centers have not focused, allowing us to build on the work of other programs (Shell Center, EEI, CES), without duplicating existing efforts (see a timeline of environmental programs at Rice).

A TIMELINE OF ENVIRONMENTAL SCHOLARSHIP AT RICE



solutions may tackle the symptoms of the "disease" (e.g. build a sea wall to keep out rising waters), they also need to address the root causes (e.g. the critical role of high carbon fuels in world economies). Finally, equality and justice must be intrinsic to this work, because injustice is a key driver of environmental instability.

Community engagement will be the key to Rice's success. To succeed, Rice's new efforts around the environment need to be radically inclusive both within and outside the university through extensive partnerships. The seeds of many of these partnerships have already been planted in existing faculty and institutional relationships with key external stakeholders, including environmental NGOs, energy industries, and local, state, and federal governmental entities. While Rice has much of the scholarship needed to generate environmental solutions, the ability to effect real change will require partnership and collaboration with local communities and policymakers. The City of Houston, for example, is interested in partnering with Rice on developing dozens of superneighborhood-level climate resilience plans.

Rice is uniquely positioned to develop a solutions-focused environmental institute. Rice's key strength in this area is its joint identities as both a liberal arts school and an R1 research institution. Our liberal arts core brings a commitment to cross-institutional conversation that supports the type of multidisciplinary scholarship needed to succeed in environmental research. Rice is experienced building multidisciplinary cores (e.g. the recent Data Science Initiative), and we are experienced at co-producing knowledge and solutions with external stakeholders. Rice's global reach and international network amplify our work, increasing its impact.

Rice has an outstanding foundation upon which to build: our institutional characteristics plus many existing nuclei of excellent environmental scholarship leave us well-poised to make a bold commitment to address both the challenges and opportunities the environment presents.



SKYSPACE AT DUSK, RICE UNIVERSITY

2.0 WHY AN INSTITUTE?

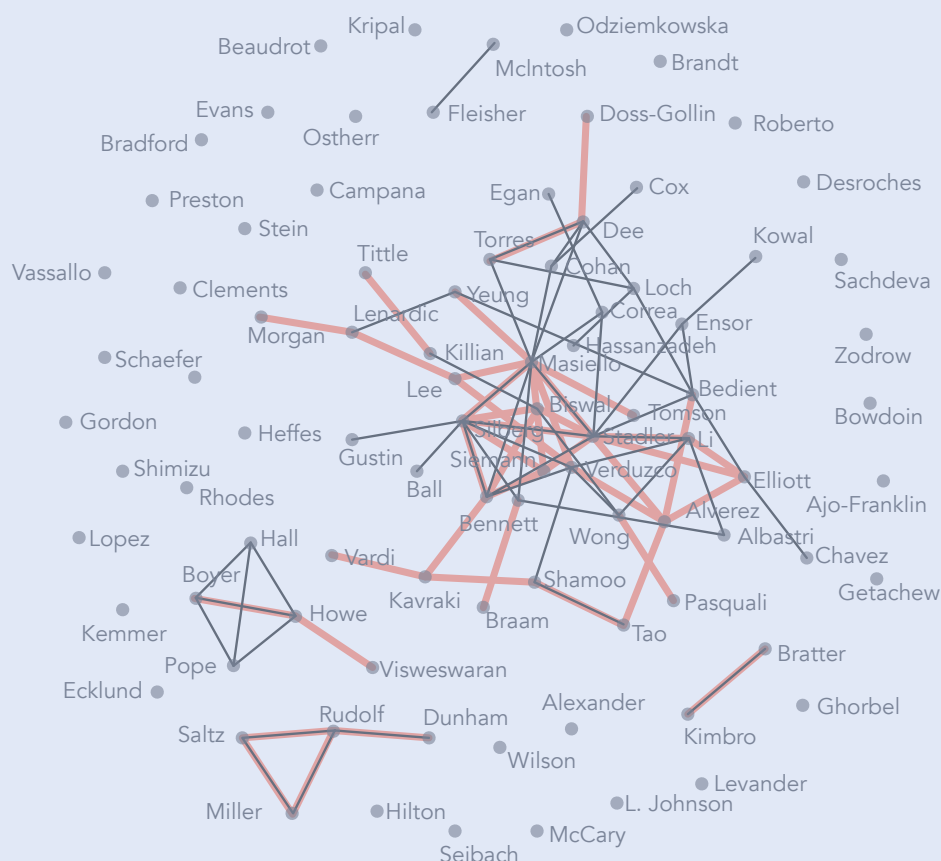
Rice is already home to an abundance of important environmental research, teaching and outreach. This activity takes place across campus in diverse schools, institutes, and centers. What Rice lacks that many of our peer institutions possess is an integrating “hub” to facilitate communication and coordination among its many active “spokes.” The absence of a high visibility hub means that Rice’s environmental activity appears to both outsiders and insiders as more disaggregated and diffuse than it ought to be.

Just as the establishment of the Kinder Institute allowed Rice to take a prominent leadership role in many urban policy issues, a strong environmental Institute at Rice would allow the university to take a leadership role in providing concrete environmental solutions for local, national, and international stakeholders. Rice would become the first leading institution in the South with a high profile environmental institute. Additionally, establishing such an institute at Rice would bring us into the mainstream of our AAU peers, 75% of whom already have established such programs.

INSTITUTE GOALS

The Rice Environmental Institute would allow the university to lead in the development of lasting solutions to environmental problems. These problems are inherently multidisciplinary, and an Institute would provide a clearly multidisciplinary hub for the development of coherent teams working together to develop innovative solutions. Current Rice faculty publication and proposal networks reflect department boundaries (see sidebar), with many of us disconnected from each other. An Institute would create opportunities to find the creative solutions that exist when we expand our professional networks. Finally, an Institute would allow for coherence in fundraising, an essential next step for Rice’s environmental scholarship community.

A FUNDAMENTALLY MULTIDISCIPLINARY HOME FOR ENVIRONMENTAL SCHOLARSHIP: The extraordinary multidisciplinary of environmental problems like climate change, energy transitions, and threats to biodiversity means that no single School at Rice encompasses the intellectual breadth needed to address their complexity. Attempts to shoehorn environmental scholarship into one or two schools at Rice have not been successful, and have led to fragmented fundraising and internal conflict. A stable, well-resourced environmental home is needed.



COHERENTLY ADDRESS ENDURING ENVIRONMENTAL CHALLENGES: We are facing decades of challenges from environmental problems like climate change. We need a formal locus on campus to address these problems over the long term and in a coherent manner.

FOSTERING A NEW GENERATION OF LEADERS AND ENVIRONMENTAL LEADERSHIP: To ensure that Rice's students are equipped with the knowledge and tools to lead in the 21st century, Rice needs to make the environment a central part of its overall educational framework. No matter what students go on to do, they will need an understanding of our systemic environmental challenges. An environmental Institute will make the University more attractive to the kinds of intellectual talents we seek in faculty and students.

NEW EDUCATIONAL OPPORTUNITIES: An Institute would allow Rice to more effectively offer programs ranging from an executive education program in climate science to undergraduate certificates in environmental leadership. Joint degree programs would also become a possibility in areas ranging from climate ethics to climate and architecture.

A COHESIVE FUNDRAISING LOCUS: An Institute would allow coordinated proposal development, supporting fundraising in a way that facilitates major expansion. We expect that new funding opportunities in environmental research will multiply in the decades to come. Envirofac scholars are already bringing substantial external research funding into Rice: \$38.3 million in FY 2021 (an 80% increase over FY 2017). Yet, as we saw in the enthusiastic response to the 2021 Sustainable Futures CVF call, Rice clearly has significant untapped potential, especially in building multidisciplinary research teams that the establishment of an Institute could facilitate in a more structured way. The lack of coherence creates

RICE'S ENVIRONMENTAL SCHOLARS ARE IN 7 SCHOOLS AND 23 DEPARTMENTS

ENGINEERING

Bioengineering
Chemical & Biomolecular Engineering
Civil & Environmental Engineering
Computer Science
Electrical & Computer Engineering
Materials Science & Nanoengineering
Mechanical Engineering
Statistics

HUMANITIES

English
History
Philosophy
Religion
Spanish, Portuguese & Latin American
Studies
Visual & Dramatic Arts

NATURAL SCIENCES

Biosciences
Chemistry
Computer Science
Earth, Environmental & Planetary Sciences
Kinesiology
Physics & Astronomy

SOCIAL SCIENCES

Anthropology
Economics
Political Science
Sociology

MUSIC

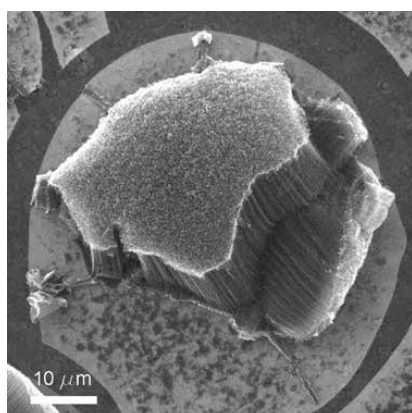
ARCHITECTURE
BUSINESS

problems at an institutional level as well, with disparate groups petitioning the administration in an ad hoc way for resources. The lack of an integrated hub also diminishes our philanthropic potential since it is difficult for the outside world to recognize the true breadth and depth of Rice's excellence in this area.

Rice cannot reach its potential in environmental research, teaching and outreach without substantial resources. An Institute would lead to additional funding flowing to the University. As we have learned from peers like Stanford, such an Institute has enormous fundraising potential; it will allow the University to make the greatest impact possible across all parts of Rice, more so than if we were to simply enhance existing structures or fund large projects. A bold commitment requires bold resources, and an Institute is the way to achieve both.

AN IMMERSIVE ACADEMIC EXPERIENCE: The scale and complexity of environmental problems require more than simply combining discipline X with discipline Y, bringing together theory and practice, or bringing scientists and designers together, etc. A new, physical "hub" is needed for academic engagement and innovation to house faculty, students, and researchers who may also sit elsewhere, but are excited by a new Institute that would effectively facilitate deep interdisciplinary activity. An environmental Institute could provide an intellectually immersive experience, generating a community where there is sustained interaction by the relevant stakeholders, internally and externally.

A TOOL TO STRENGTHEN RICE'S RECRUITMENT AND RETENTION: A vibrant Environmental Institute will facilitate the recruitment of both young scholars and established leaders in a research area that is predicted to grow in relevance in the decades to come. The Rice Environmental Institute would elevate their achievements and promote their scholarship.



GRAPHENE/NANOTUBE HYBRID

3.0 ENVIRONMENTAL RESEARCH AT RICE

ENVIRONMENTAL RESEARCH AT RICE CAN CHANGE THE WORLD

Rice University has ample talent to make important contributions to environmental scholarship and leadership in the coming century. Rice can transform and elevate current environmental scholarship through a university-sponsored Institute, growing environmental scholarship and leadership with the collaborative infrastructure created by a topical Institute.

3.1 EXISTING RESEARCH STRENGTHS

Research excellence related to the environment at Rice is broad, with multiple faculty groups leading established, world-renowned programs. However, these clusters are largely confined to individual departments and/or schools; there is much latent potential for transformative research across these groups.

Rice has an established track record with centers for interdisciplinary excellence upon which a Rice Environmental Institute could build (e.g., Kinder Institute, Baker Institute). The Engineering Research Center for Nanotechnology-Enabled Water Treatment (NEWT) is a multi-institution, NSF-funded research center headquartered at Rice that includes members from the CEVE, CHBE, CHEM, MSNE departments. The Smalley-Curl Institute also conducts pioneering research connecting nanotechnology to the environment. In addition, the Severe Storm Prediction, Education and Evacuation from Disasters (SSPEED) Center has been a leader in helping the Gulf coast region prepare for potential disasters and assess future risks in a changing climate. Finally, the Center for Environmental Studies (CES) has an established reputation as an international leader in the field of Energy Humanities, producing graduate students and postdoctoral scholars who are sought-after as junior faculty in addition to hosting symposia, visiting fellows, and postdocs.

The existing centers bridge allied disciplines around specific environmental problems, but the possibilities at Rice are much broader. Our strengths in the social sciences, geosciences, and biology, for example, have rarely intersected, an issue which can be addressed with an organized institute. Areas of strength that cut across across schools include, but are not limited to:



Biodiversity (ANTH, HUMA, EBIO, EEPS)
 Climate adaptation and decision-making (CEVE, ECON, ANTH)
 Climate dynamics (EEPS, MECH, CEVE)
 Energy technology (CHBE, MECH, ECE, Baker Institute)
 Environmental sensing (EBIO, ECE, CEVE, EEPS)
 Environmental health, justice, and inequality (KINE, STAT, SOC, SOCI, HUMA, ECON, POLI, CEVE, CAAAS)
 Human culture, environmental perceptions, and responses (ANTH, HUMA, ARTS, ARCH, SOCI, STAT, RELG, LING, HIST)
 Human impacts on the environment (CEVE, EBIO, Kinder, EEPS, BIOS, CHBE, SPPO, HUMA)
 Robotics in environmental monitoring and remediation (ECE, MECH, COMP)

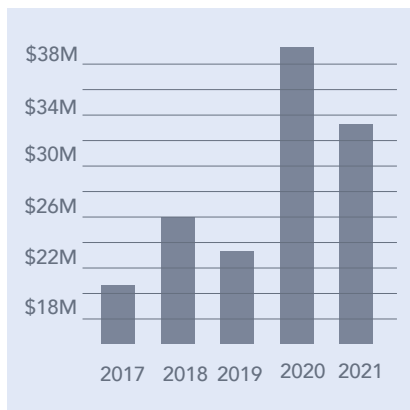
Like many other cities, Houston confronts daunting challenges as it undergoes rapid growth in a coastal environment as the climate warms. Rice has played a pivotal role in helping our region address those challenges through centers such as the Kinder Institute and the SSPEED Center. Research spanning the natural sciences, engineering, social sciences, humanities, and architecture is needed to better characterize the challenges that cities face, and design solutions with broad relevance in this region and beyond. By establishing an Environmental Institute at Rice, we have an opportunity to bring Rice's unconventional wisdom to perhaps the defining twenty-first-century problem—how we as a global community can prosper together without harming one another. We can do this by working not only across disciplines, but also across sectors to advance the frontiers of knowledge and action in the place we call home.

3.2. RESEARCH NEEDS

Rice has an abundance of untapped strength in environmental research spanning all seven schools (see sidebar). While other interdisciplinary research centers and institutes exist on campus, none are focused on the environment in a way that is sufficiently broad and inclusive to support and catalyze interdisciplinary environmental research. Our faculty need a gathering point, an intellectual "home base" in this area.

Prior efforts to bring together Rice's efforts on energy and the environment such as the Shell Center for Sustainability, the Energy and Environment Initiative, and the Energy and Environmental Systems Institute have been piecemeal, focusing primarily on environmental scholarship perceived to be of interest to the oil and gas industry. While excellent scholarship has occurred through these previous centers and institutes, their perceived existence as a service to the oil and gas industry has alienated the majority of environmental scholars on campus and limited the potential of interdisciplinary collaboration. New, creative opportunities





REI FUNDING 2017-2021

Fundraising: over the last 5 years, REI scholars have raised 150 million dollars, with positive trends that indicate strong potential for growth.

External Funding Opportunities

DOE Biological and Environmental Research
 NASA Biological Diversity and Ecological Forecasting
 NOAA RESTORE Science Program
 NOAA Adaptation Sciences Program
 NIH Systems Biology for Infectious Disease
 NSF Biodiversity on a Changing Planet
 NSF Ecology and Evolution of Infectious Disease
 NSF Emerging Frontiers in Research and Innovation: Biomining for sustainable metal extraction and resource recovery
 NSF Frontier Research in Earth Science
 NSF Organismal Response to Climate Change: Expanding Understanding and Improving Predictions of Life on a Warming Planet
 NSF AI for Climate-Smart Agriculture and Forestry
 NSF Coastlines & People Hubs for Research & Broadening Participation (CoPe)
 EPA Environmental Education Grants
 GULF COAST RESTORE ACT FUNDING

exist to partner with the global energy industry (e.g. the Carbon Hub, the Center for Energy Studies), and would benefit from connections to broader environmental scholarship so that Rice can also lead holistically in this space. A new Institute for the environment is needed to bring together Rice scholars working at this and similar interfaces to attack the complex problems related to the environment that span the social, built, and natural world.

After a study of comparable and aspirational environmental research institutes within the American Association of Universities, the task force recommends the following research activities and resources in a future Institute to foster excellence that will grow Rice's profile in environmental research, stimulate growth in sponsored research funding, and broaden Rice's intellectual and artistic footprint:

1. Topical, university and/or partner-sponsored competitive funding awards for multidisciplinary research related to the environment (awards ranging from \$50,000-500,000/year). This structure will complement existing mechanisms currently offered by the university (e.g., Faculty Initiatives Fund, Interdisciplinary Excellence Awards) by focusing topically on the environment, offering more opportunities for collaborations among currently disconnected faculty units. The highly successful 2021 Sustainable Futures call from the Creative Ventures Fund could serve as a model.

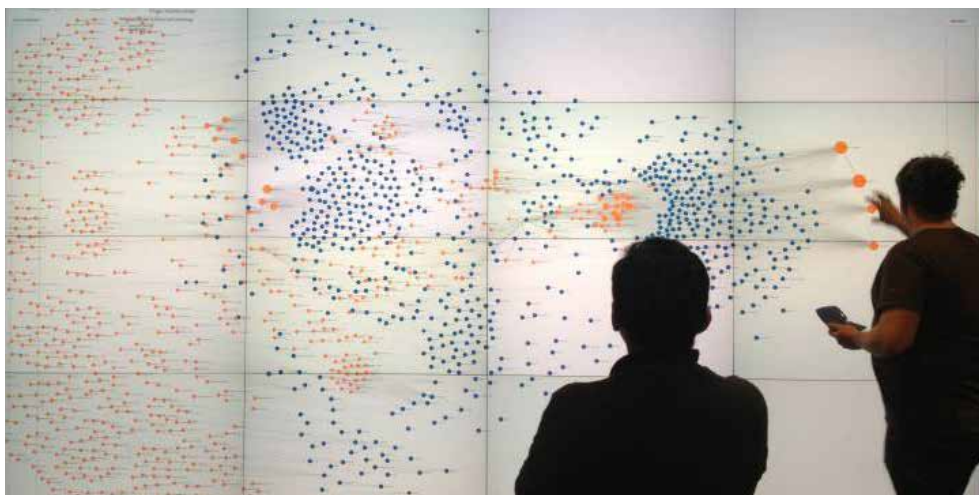
These funding awards should have the spirit of seed funds, but also be sufficient to support a proof-of-concept project from beginning to end. Conversations with former directors of successful environmental institutes at Rice's peer universities (e.g., Precourt and Woods Institutes at Stanford) suggest that an emphasis on new concepts and collaborations, and incorporation of rigorous external peer review, will increase the program's impact both in terms of scholarship and ability to attract follow-on funding. A fair structure for evaluating proposals from disparate disciplines, one that is broadly inclusive and provides feedback, will be important for fostering creative dialogue among scholars at Rice who may not typically work together.

Similar programs at other interdisciplinary environmental institutes have a strong track record of generating not only high-impact scholarship, but also large external public and private grants. Both of these outcomes are in line with Rice's Vision for the Second Century.

2. New faculty lines and additional support for graduate-student and postdoctoral training that bridge existing strengths at Rice and position the university toward interdisciplinary growth and excellence in environmental research. These faculty would ideally span departments and schools, serving as vital 'glue' for a cohesive environmental program. Many peer institutes at AAU schools have these bridging positions; importantly, they serve to broaden the resource base from which extant departments can draw. Some may be senior hires who bring their eminence and collaborative networks, although an emphasis on emerging fields may yield greater longevity and cumulative impact.

Examples of bridging areas include environmental justice, remote sensing, pollution and health, carbon capture and climate mitigation, environmental/natural resource economics, the socioeconomic dimensions of biodiversity conservation, and alternative energy technologies including solar, geothermal, and wind. These and other areas could benefit substantially from strategic hires, and are areas where Rice could become a world leader given its current strengths and geographic proximity to the Houston Medical Center, the Ion innovation hub and Greentown Labs, and the headquarters for the global energy industry.

Recruiting new faculty in emerging environmental fields will also allow Rice to attract new funding (e.g., large interdisciplinary grants) as well as a diverse pool of top graduate students and postdoctoral scholars to widen our scholarly footprint both nationally and internationally. Examples of previous efforts in a similar vein



include four focused faculty hires associated with the Data Science Initiative, as well as fortuitous faculty hires associated with Planetary Science and Astronomy that helped the university lead and win a \$7.7 million NASA Nexus for Exoplanet System Science (NExSS) grant. Of course, the university should consider how tenure and promotion would be adjudicated in multidisciplinary positions. Establishing guidelines for these hires will be important to retain a fair and balanced path to promotion for talented new faculty.

3. Multidisciplinary environmental symposia. More than traditional research-focused symposia, thematic events will bring together on- and off-campus scholars in allied disciplines studying a common problem (e.g., water, energy transitions, conservation) and include a forum for artistic works and student/postdoctoral research. These symposia will help grow Rice's visibility locally, nationally, and internationally as a hub for world-changing ideas and collaborations.

Rice has a track-record of similar symposia, such as the annual SSPEED Center and Data Sciences conferences, the Cultures of Energy symposia, and the Industry-Rice Earth Science Symposium (IRESS), but they tend to be anchored in specific centers or departments—thus limiting their audience and reach. The Institute would provide a venue for conferences in emerging areas of environmental research. This convening power is important for establishing eminence in environmental scholarship. We note that Envirofac members expressed a strong desire for a multidisciplinary symposium series when the group discussed a new institute.

4. A common space for research and creative activities. Emerging multidisciplinary scholarship is best facilitated by increasing opportunities for faculty with mutual interests to engage each other in scholarly dialogue, both in formal and informal settings [NAP Convergence report, Mitchell report]. Similar spaces for cross-disciplinary collaboration exist at peer and aspirational institutions (e.g., Bio-X at Stanford, the Resnick Institute at Caltech, and the Stata Center at MIT) that have added to their global eminence fields that were emerging at the time (i.e., bio-engineering, sustainability, and artificial intelligence). We are sensitive to campus carbon footprint issues so we are not necessarily advocating a new space. Creative reuse of existing space is often the better solution.

In any event, we envision that the space will (1) connect subsets of disciplinary faculty working on environmental problems, e.g., house several faculty "clusters" working together or on allied themes from across campus, (2) allow new hires to weave a unique interdisciplinary fabric and (3) serve as a space for research, teaching and symposia.

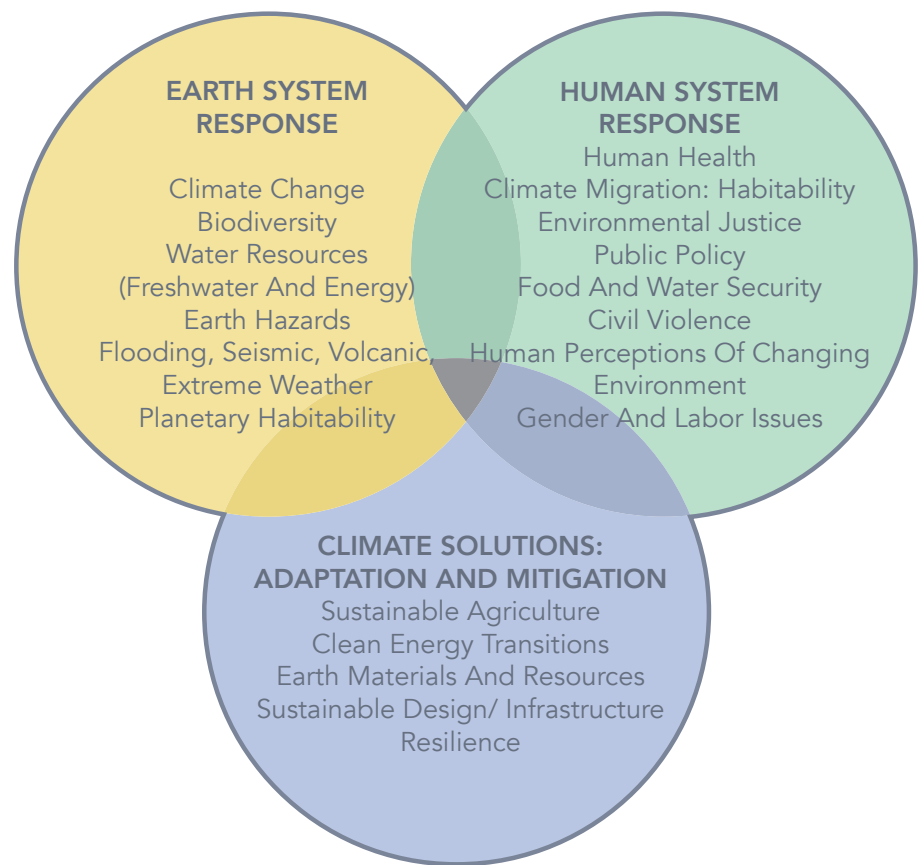


HOUSTON AS LABORATORY

Houston as a Test Lab for Problem-Solving: Houston is a growing city in the global humid subtropics, making it an ideal model for many locations in both the developed and developing world. Many of Houston's environmental challenges can serve as models for national and international environmental challenges. In coordination with the Kinder Institute's Houston Solutions Lab we will use Houston as a test site for innovative environmental solutions.



A MALAGASY MOON MOTH (ARGEMA MITTREI) PHOTOGRAPHED BY RICE RESEARCHERS NEAR RANOMAFANA NATIONAL PARK, MADAGASCAR. ONE OF THE WORLD'S LARGEST SILK MOTHS.



3.3. PROPOSED FOCAL THEMES

The Task Force, after receiving input from the Envirofac membership via multiple town-hall-style meetings, proposes the following three focal research themes: Our Changing Natural World, Human-Environmental Transformation, and Conservation, Adaptation and Mitigation. Example topics within the three research themes are listed below.

1. Our Changing Natural World: climate change, biodiversity, water, natural resources, and natural hazards.
2. Human-Environmental Systems: Environmental economics, environment-driven migration and civil conflict, environmental inequality and justice, food and water security, and culture and education in a changing environment.
3. Conservation, Adaptation and Mitigation: Energy technology and sustainability, agriculture, natural resource management, designing for environmental resilience, carbon capture and storage, environmental decision-making.

Topical overlap is inevitable between themes, and we argue that it is vital to the Institute's health and success. All modern environmental problems exist at the interface between society and the natural world; each of these themes focuses on a different part of this interface. To make these ideas more concrete, we present below three example research problems that fall within the purview of one theme, but would inform and be supported by the others. The research problems represent directions that could easily capitalize on existing strengths at Rice, and are intended to serve as examples rather than recommendations.

OUR CHANGING NATURAL WORLD: Local, regional, and national communities face unique challenges from environmental change, but share a common need

for multidisciplinary scholarship in finding sustainable solutions. Drought, flooding, and extreme weather are all threats in Texas, for example, while sea-level rise and freshwater resources are long-term concerns in Florida. While these specific regional patterns of change differ, both locations require scholarship aimed at understanding the physical and social dimensions of our relationship with the hydrological cycle. The histories of thought and action that have led societies to this juncture will affect how the public and private sectors manage their environments and natural resources in the forthcoming decades. Yet, models still cannot predict how specific environments will change, let alone how society can prioritize and plan for these inevitable disruptions.

How will our local environments change? How can communities adapt? Scholars at Rice are working to improve climate and weather prediction, infrastructure resilience, decision-making, ecosystem conservation, energy and resource technologies, natural hazards, and community engagement to prepare our society for this uncertain future. Rice has a “critical mass” of these faculty whose research topics, while clearly allied, remain largely disconnected.

The Rice Environmental Institute would connect our scholars and their community partners, catalyzing rapid progress toward identifying urgent needs in environmental adaptation and mitigation. We can be a world leader by recognizing how connections between the natural sciences, engineering, social sciences, and architecture lead to effective, robust societal action.

HUMAN-ENVIRONMENTAL SYSTEMS: The annual net value of services supplied by the natural world to the global economy has been estimated to be around \$33 trillion. How much of this value is at risk? To whom or what does this value belong, and how does the value structure affect the behavior of individuals and societies? The urgency of these questions is palpable, especially for Houston and Texas, which are in many ways a microcosm for several global environmental challenges. For example, in Texas, many ecosystems are in privately-owned natural lands. These systems provide several social benefits, such as acting as carbon sinks, reducing flooding, and providing habitats for wildlife. What is the optimal balance between the benefits from preserving the ecosystem services on these lands, versus converting and developing them for industrial use?

Moreover, climate-related damages affect societal well-being in ways that go well beyond the direct effects on economic productivity. They include, among others, costs from lost biodiversity, adverse effects on agriculture, the potential for large-scale immigration and conflict, and the spread of vector-borne as well as novel zoonotic diseases. As humans move more deeply into biodiversity hotspots and drive species migration around the world, the risk of novel, cross-species disease transmission will increase (see COVID-19 sidebar). The impact on human well-being is likely to include famine, the disruption of food chains, declines in the availability of freshwater, decreasing ecotourism, and the lost potential for discovering new drugs to treat diseases.

Scholars in the Schools of Natural Sciences, Engineering, Business, Social Sciences, Humanities, as well as the Baker Institute for Public Policy are working on disparate elements of this problem. These elements range from understanding ecosystem services and their relationship to biodiversity to pricing and testing conservation agreements to exploring human-ecosystem relationships as portrayed in literature and art. These faculty would find new, transformative insights if provided a supportive institutional setting in which to work together more closely and often. There is likely no “one-size-fits-all” value for our ecosystems, nor singular solutions that fulfill the needs of all communities given the diversity of cultural norms and priorities. Public and private decision-making stands to benefit greatly from Rice’s engaged scholarship.

CONSERVATION, ADAPTATION, AND MITIGATION: The environment today is already significantly different from the one in which our parents grew up. Future

RICE ECOLOGISTS IN MADAGASCAR





COVID AND THE ENVIRONMENT

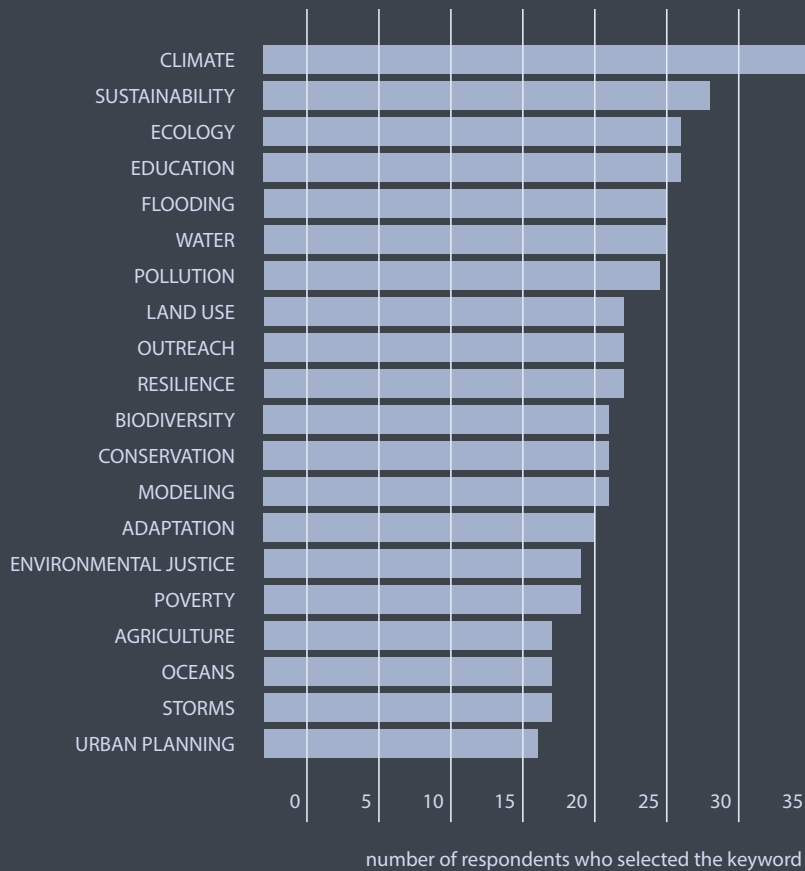
In recent years COVID-19 has upended every aspect of life around the world, causing tragic loss of life, tremendous economic losses, and exacerbated social inequality. The emergence of zoonotic diseases is not a new phenomenon, but may be accelerated by more human-animal interactions arising from deforestation, wildlife markets, and climate-driven ecosystem shifts. In addition, the effects of the pandemic are not experienced equally across the population. Associated issues of environmental health and equity urgently deserve rigorous interdisciplinary study.

environments will likely differ even more dramatically from those we know today, whether measured in terms of mean annual temperatures, rainfall, shifting habitats and biomes, or housing affordability. Predicted future changes in climate and global development augur enhanced risks for communities across the world (e.g., sea-level rise, flooding, drought, and increased climate variability). However, we do not know how community sentiments, economic opportunity, physical infrastructure, and basic human needs like water and health will be concretely impacted by these risks. Innovative technological and design solutions are no doubt necessary, but they must be integrated into human societies that may have competing values. In short, we will have to adapt to and mitigate inevitable environmental upheavals while being mindful not to repeat the mistakes of our past.

Scholars at Rice are working on all sides of this problem. Faculty in the Schools of Natural Sciences and Engineering are developing new water-treatment and energy technologies, adaptive building materials, and schemes for carbon capture, storage and utilization. Faculty in the schools of Social Sciences and Humanities are improving our understanding of the effects of environmental change and urban development on health and social inequality and how individuals and groups bring about institutional change. Meanwhile, faculty in Architecture are re-examining urban spaces in light of climate change, while the SSPEED Center is working with local stakeholders on mitigating flood risk in the city of Houston. Again, the Environmental Institute would serve as the hub capable of organizing these spokes of scholarship together to accelerate the integration of knowledge, innovation, and action.

3.4. RICE'S OPPORTUNITY

Rice is in a unique position to solve the most complex and important problems of environmental change: those that lie at the intersection of the natural world, technology, and the human experience. Our review of peer AAU institutions shows no other university-based environmental entity that is yet approaching these critical problems with a truly holistic and omnidisciplinary approach. We envisage the Rice Environmental Institute as a place where all the intellectual resources and expertise of the university could be assembled and leveraged toward improving understanding of our environmental challenges and improving the design of scalable yet locally attuned solutions.



SUMMARIES OF RICE ENVIRONMENTAL SCHOLARS' SURVEY

In the summer of 2019 a survey of Rice environmental researchers was conducted asking them to choose key words identifying where their specific research expertise lay (see bar chart). We also gave them the opportunity to answer open-ended questions about where they wanted to see Rice's environmental scholarship grow. Social science faculty led the survey design and compiled researcher responses into narrative summaries (see left).

Where should Rice focus in environmental research?

The open-ended responses show a strong consensus forming around the need for building interdisciplinary environmental research capacity at Rice around key contemporary environmental challenges. Among the challenges most frequently named were biodiversity loss and conservation, climate change and mitigation, coastal adaptation, energy transition, urban environments and water. Some of these are already areas of research excellence at Rice; others would need to be developed. There is especially strong support for impactful, change and solution-oriented research.

Where should Rice focus in environmental education?

There is strong support in the open-ended responses for creating a more coherent environmental curriculum across multiple shareholder departments and programs. In terms of the content and orientation of that curriculum, multiple respondents suggested foci on undergraduate research (also taking advantage of campus and Houston as living labs), on raising basic environmental literacy campus-wide, on climate change and its impacts, on sustainability and planning, on biodiversity, on energy transition, and on environmental justice. Several respondents spoke positively of the possibility of interdisciplinary collaboration as a way to help students appreciate the complexity of contemporary environmental challenges.

Where should Rice focus in environmental outreach?

There is very strong consensus among respondents that Rice's focus in environmental outreach should be primarily local in two senses: first, Rice's campus should become a site of environmental engagement with commitments to lowering Rice's own carbon footprint, to restoring its natural landscape, and using campus as an environmental lab and exemplar for the rest of the city. Second, respondents feel strongly that Rice should be reaching out to local K-12 schools, to local and state civil society organizations, to city and county government and to industry and the private sector to help improve environmental understanding and to engage in collaborative projects of environmental action. Respondents do not seem opposed to the idea of national and international outreach so much as they feel that there is much good to be done closer to home given the extreme environmental challenges that Houston and other Texan communities already face.

Survey of Environmental Faculty, July 2019, (Response Rate 80%)



4.0 ENVIRONMENTAL EDUCATION AT RICE

4.1 ENHANCING CORE STRENGTHS IN ENVIRONMENTAL EDUCATION

The Rice Environmental Institute will seek to support, enhance and connect the many existing environmental courses and education programs on campus. Through building new connective tissue, the Institute will enrich Rice's environmental education experience by connecting all stakeholders on campus and integrating new and existing conversations with partners outside the university.

Every student that graduates from Rice should have a baseline literacy in environmental issues, from the science of climate change to the social, cultural and political factors that impact the ecosystems of our changing planet. In the process we must provide students with transferable skills that emerge from understanding and addressing environmental challenges. The environmental problems Rice graduates will need to solve in the 21st century will rarely be amenable to simple fixes. Our graduates will need to pair skills derived from STEM environmental disciplines with the approaches and insights drawn from social scientists, humanists, and artists to imagine, communicate, and implement solutions that help make a changing world more livable and equitable. Learning how to work with students from other disciplines to tackle complex environmental problems is crucial: no individual can have depth in all subjects.

Rice enjoys considerable forward momentum in environmental education already.

In 2015-2016 faculty from the Schools of Architecture, Engineering, Humanities, Natural Sciences and Social Sciences (and in coordination with the Baker Institute and the Jones School) worked together to develop and implement a new Environmental Studies minor degree program and a substantially reformed Environmental Sciences major degree program. That collaborative process led to the realization that there is a strong interest in environmental issues on campus among faculty, students and administrators. Rice faculty now offer 170 courses across 38 different departments and programs related to environmental issues. Over the past five years, the number of Environmental Sciences majors and Environmental Studies minors has quadrupled. However, this educational landscape is not yet optimally integrated. Multidisciplinary, multi-school curricular structures and initiatives are essential for Rice to provide students with the education necessary to solve real, 21st century environmental problems.

The overall pedagogical goal of the Rice Environmental Institute will be to work together with Schools and Departments to foster excellent and integrated environmental education across campus.

At the undergraduate level, the Institute will help provide students with a fundamental understanding of environmental change and associated challenges to the human and built environment. The Institute will cultivate courses which (1) introduce students to environmental problem solving and multidisciplinary research; (2) identify problems and teach students to solve those problems via multidisciplinary collaboration that leads to creative solutions, and (3) connect students with off campus partners who can provide students with real-world problems in need of their help.

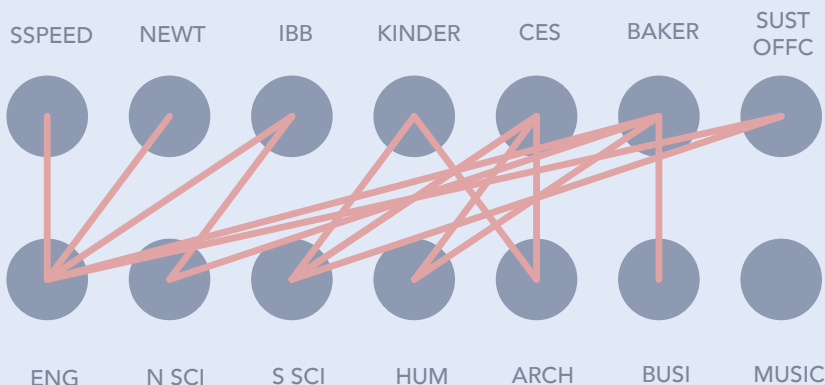
At the graduate level, the Institute will increase Rice's visibility to talented Ph.D. applicants in all fields, encouraging their enrollment in our programs. The Institute will invest in training graduate students to engage in multidisciplinary environmental problem solving teams (e.g., through NSF training grants). These types of leadership skills are crucial in the 21st century workplace. Because the role of graduate students in these projects will be non-trivial, we propose that graduate student participation in the Institute come with TA support during the relevant semesters.

Undergraduates and graduate students alike benefit immensely from extra-curricular efforts such as internships and off-campus research experiences. We envision the Rice Environmental Institute supporting the expansion of environment-related internship opportunities through the Rice Office of Sustainability and Rice Center for Civic Leadership (<https://ccl.rice.edu>) as well as spring break and summer environmental learning experiences, field programs, and other curricular enrichment programs.



ACADEMIC COORDINATION

Academic structures at Rice do not effectively coordinate interdisciplinary environmental research and education. The adjacent diagram illustrates the many uncoordinated connections between existing institutes and schools with Rice environmental researchers. A Rice Institute of the Environment would effectively coordinate and cross-reference these isolated channels into one cross-disciplinary clearinghouse for information. The synergistic effects combining these connections would be a boon to Rice's environmental studies.



EARTH DAY, GIRL SCOUTS



4.2. NEW INITIATIVES IN ENVIRONMENTAL EDUCATION

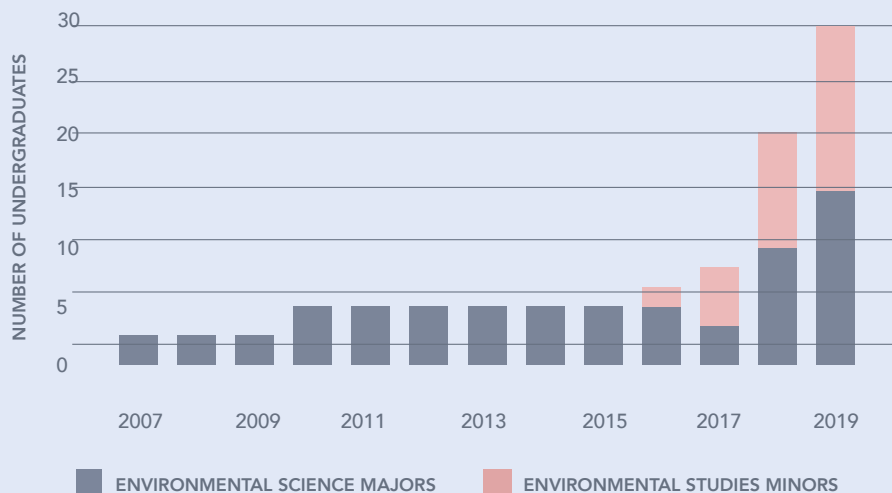
The Rice Environmental Initiative will be well-positioned to stage three kinds of new initiatives in environmental education: 1. Developing new interdisciplinary education programs, 2. Establishing a coordinating environmental curriculum council, and 3. Incubating new community education programs.

1. NEW INTERDISCIPLINARY EDUCATION PROGRAMS. With only modest investments Rice could greatly expand our environmental education footprint on campus and throughout the Houston community. Programs well-within Rice's capabilities include:

UNDERGRADUATE CERTIFICATE PROGRAMS IN CLIMATE COMMUNICATION AND ENVIRONMENTAL LEADERSHIP. Through coordination of existing courses and modest investment in staff, the Institute could offer at least two certificate programs. A climate communication certificate would involve the completion of a sequence of 3-4 science and humanities courses coupled with a communication project (e.g. writing an op ed, delivering a presentation to a local K-12 school, or meeting with a government representative). An environmental leadership certificate could similarly be developed in collaboration with the Doerr Institute, and would differ from the climate communication program in course content and through inclusion of Doerr-specific leadership development skills.

GRADUATE CERTIFICATE IN ENVIRONMENTAL EDUCATION. We envision opportunities for graduate students to act as mentors for multidisciplinary undergraduate research teams. These graduate students would receive training in both team leadership and environmental education, as well as a semester's stipend. Successful mentoring of an undergraduate team would include leading them through problem identification, development of community partners, construction of a research plan, and delivery of a final project. Graduate students acting as mentors would meet together weekly to build their multidisciplinary team leadership skills, following the graduate interdisciplinarity education model now in place in bioelectronics.

EXECUTIVE EDUCATION PROGRAM IN ENERGY, ENVIRONMENT, AND CLIMATE. Rice already has the faculty and curricular materials to launch an executive education program aimed at Houston-area industrial leaders. This program would offer executives a deep look into the science of climate change coupled with a primer on our available responses. Built in collaboration with the Baker Institute's Center for Energy Studies, this program would consider the energy and economic implications of each potential climate change response. We envision a program similar to the current Harvard Kennedy School "Climate Change and Energy" executive education program, potentially using the MIT Sloan school's new climate solutions simulator to rapidly explore the multidimensional consequences of each potential solution.

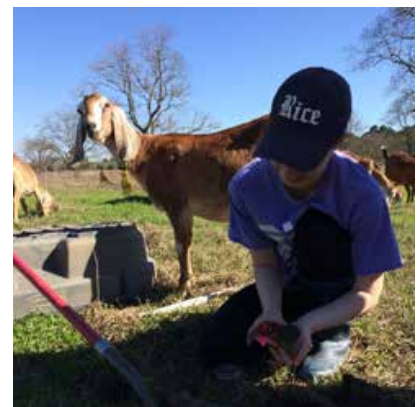


EDUCATION FACT SHEET

- In a survey conducted of the undergraduate students, 52% of students indicated that they want to learn about the challenges of climate change in the classroom.
- The past 5 years have seen exponential growth of the environmental science major and environmental studies minor (see above).
- Environmental courses have rapidly growing enrollments across campus. The ENST 100 core course met its enrollment limit of 75 within seconds for Fall 2022.
- A recent in-class poll of students in ESCI 201 (The Science of Climate Change) indicates a desire for increasing environmental literacy for all students at Rice. We envision that all students have the opportunity to take at least one course surrounding environmental issues to expand this literacy amongst the student body.
- Students also requested larger emphasis from the university and career center on green jobs, and academic events related to the environment.
- Several students reported “Feeling alone” and a lack of cohesion. Students have a need for more community, which an institute will provide.

2. **ESTABLISH AN ENVIRONMENTAL CURRICULAR COUNCIL.** Rice has multiple, currently disconnected environmental education programs on campus (see sidebar). These include four majors within NSCI and ENGI, which together offer 9 separate specializations and four environmentally-focused minors within NSCI, ENGI, and HUM. However, there is significant loss of faculty resources due to course and major redundancies. We propose a curricular council for undergraduate environmental curricula to harmonize courses, reduce teaching load to recover faculty time, and improve student experiences. The basic task of this council would be to ensure that departments running environmental education programs are fully cognizant of the courses, internship opportunities, and extracurricular programs offered at the university. This council would also act as an interface for the growing number of undergraduate and graduate student environmental groups. Finally, the existence of this council would create a strong, multidepartmental faculty nucleus who could write grant proposals for further program development.

3. **STRENGTHEN COMMUNITY OUTREACH FOR ENVIRONMENTAL EDUCATION.** The Rice Environmental Institute will provide education in interdisciplinary environmental issues in collaboration with the Glasscock School of Continuing Studies, local schools including Furr High School (HISD school devoted to environmental problem solving), and by connecting community members with faculty to design citizen science opportunities. We envision long-term institutional connections to government, industry, other schools, and NGOs in need of creative environmental solutions. We will draw from the model developed by the Boniuk institute for K-12 outreach, working alongside the Rice office for STEM engage-



SOIL RESEARCH AT BLUE HERON FARM

ART AND ENVIRONMENT

Rice Public Art's "Off the Wall" series will commission a site-specific installation by a recent alumnus or alumna of the Core Residency Program at the Glassell School of Art. Each installation will be on view for one year on the south wall of the Raymond and Susan Brochstein Pavilion. A new commission will be featured each year for three years.

The inaugural artist in the series is Harold Mendez (b. 1977). Mendez's work often integrates photography and sculpture to explore notions of identity and place. A first-generation American born in Chicago to Colombian and Mexican parents, Mendez addresses history and meaning in the context of geography and cross-cultural discourse.

Rice hosted two exhibitions as part of FotoFest's 16th International Biennial of Photography and Mixed Media Arts, from March 12 through April 24, 2016. "Dear Climate" collected agitprop posters and meditative audio experiences to "help people meet, befriend and become climate change," according to the organizers. "Another Storm Is Coming" considered the impact of present energy uses and imminent climate futures, "seeking hope in devastation through (Natal's) characteristically contemplative photographs and videos." Both exhibitions are sponsored by the Arts and Media Cluster of Rice's Center for Energy and Environmental Research in the Human Sciences (CENHS).

JUDY NATAL, EXHIBITION, 2016, SOLAR CONTAINERS



ment. Rice's environmental researchers already have broad connections at the local, national, and international levels that they individually use when designing and implementing building specific outreach projects for environmental education. The Rice Environmental Institute will create a focal point for these collaborations, helping Rice scholars to tap into each others' professional webs for research and educational program development (see Section 5: Community Engagement for more details).

ALIGNMENT WITH V2C2. Rice's V2C2 asks that we "provide transformative undergraduate education," "build renowned graduate programs," "extend Rice's reach and impact," and "engage Houston and empower its success." Few areas allow Rice the opportunity to achieve these goals as effectively as do our efforts to address environmental issues in the 21st century at local, regional, national, and global scales. To mention just a few examples, Rice faculty currently work to produce new forms of energy and storage techniques; to develop hydrocarbons that do not produce greenhouse gas emissions; to assess and address coastal risk and resilience; and to evaluate techniques for changing human behaviors that are environmentally damaging. Such efforts are already central to Rice's impact on the world and will become more so as we integrate research into a more supported and connected curriculum.

AL GORE AT TUDOR FIELD HOUSE, 10/25/17



ENVIRONMENTAL MAJORS AND MINORS OFFERED AT RICE

school	dept.	degree	description
--------	-------	--------	-------------

environmental majors offered at Rice

ENGI	ChBE	BSCHE	specialization, Environmental Engineering
		BSCHE	specialization, Sustainability, Energy
	CEVE	BA	concentration, Environmental Engineering
		BSCE	specialization, Environmental Engineering
		BSCE	specialization, Hydrology, Water Resources
NSCI	EEPS	BA	
		BS	specialization, Environmental Earth Science
	ENVS	BA/BS	concentration, Earth Science
		BA/BS	concentration, Ecology and Evolutionary Bio

environmental minors offered at Rice

HUMA	ENST.	minor	environmental studies
ENGI	EWS	minor	energy and water sustainability
NSCI	EEPS	minor	earth, environmental and planetary science

degrees with significant environmental content offered at Rice

ARCH	ARCH.	environmental architecture courses
SOCI	ANTH	environmental anthropology courses
	SOCI	environmental sociology courses
NSCI	BIOS	co-hosts ENVS major
	ECON	environmental economics courses
	KINE	environment and public health courses
HUMA	ENGL	environmental literature, co-hosts ENST
	HIST	environmental history courses
	SPPO	Latin America environment courses
MLSC	MLSC	environmental science, literature courses

FENOSOA, MADAGASCAR, 2014



RICE'S MAJORS AND MINORS IN THE ENVIRONMENT

Rice has four departments/programs that offer undergraduate majors with an explicit environmental focus: Chemical and Biomolecular Engineering; Civil and Environmental Engineering; Earth, Environmental and Planetary Sciences; and Environmental Science. Each of these majors are available in multiple areas of specialization (e.g. CEVE offers a BA, a BSCE in Environmental Engineering, and a BSCE in Hydrology and Water Resources). There are an additional three environmental minors, each of which is located in a different school: Environmental Studies (in HUMA/ARCH), Energy, Water, and Sustainability (in ENGI), and Earth, Environmental and Planetary Sciences (in NSCI). Finally, there are another ten departments which offer discipline-specific environmental coursework, located in 5 schools (see Table).

BROWNWOOD SUBDIVISION, MARSH RESTORATION PROJECT, 1984



URBAN RESILIENCE, 1983

Site of Brownwood subdivision reclaimed in 1983-84. Once a highly desirable residential neighborhood, Brownwood had over 400 substantial homes on a 500-acre (2.0 km²) peninsula. Most of Brownwood was condemned by FEMA after Hurricane Alicia destroyed all but a few of the homes there in August 1983. Immediately thereafter, the City of Baytown started buying out the properties of neighborhood residents. In 1984, the City prepared its first master plan to transform these properties into a public park and wildlife sanctuary. In 1991, Baytown's voters approved bonds for the Brownwood Marsh Restoration Project. Today, the subdivision is the site of the Baytown Nature Center.

5.0 ENVIRONMENTAL ENGAGEMENT AT RICE

There are certain moments in the life of an academic institution in which the need to look to the problems of its immediate community and region becomes pressing. Natural disasters such as hurricanes or earthquakes fall into this category. There are other moments in which national and global concerns demand its attention. Global pandemics or warfare fall into this category. Rare, if not unprecedented, are the moments in which both local and global crises demand a response from the academic community. Given the world's multiple and growing environmental challenges, this is the moment in which the students, faculty and staff of Rice find ourselves living through today. In response to this moment, our research and our teaching must look to these problems as they impact our internal academic community, the city and region in which we are located and the national and international constituencies in which we exist. Given the unique strengths of Rice, and its extraordinary urban and natural setting, our track record in local and global environmental engagement is to be envied. Rice Environmental Institute would allow the university to both focus and redouble these efforts.

Looking ahead, it is clear that successful engagements in research and teaching will require more than simple outreach: they will require a long-term dialogue that envisions our community as a central partner in design and execution of our scholarship. Strong partnerships around environmental challenges will require an institutional platform that sponsors discussions with other academic institutions, with governments, non-profit organizations, businesses and community stakeholders of all types. Rice Environmental Institute will create a nexus for these partnerships at four interrelated scales: the university scale, the local/regional scale, the national scale and the global/international scale. Through a platform provided by the Institute, exchanges between and within these four scales will promote synergies between the important work that is today done at Rice. Through these exchanges, the Institute will deliver sound, responsive and equitable environmental policies and practices that prove to be effective in an increasingly interconnected and precarious world.



5.1 UNIVERSITY ENGAGEMENT: EXCELLENCE THROUGH COLLABORATION AND COORDINATION

While the quality of Rice's research matches or exceeds that of peer institutions, it lacks an institution level, campus-wide environmental research platform to combine our excellent scholarship and teaching into effective solutions. Of the eight existing Institutes on campus, none include the environment as their central mission. Similarly, of the 43 Centers on campus, none have a focus that includes Rice's breadth of environmental scholarship. There are, however, two excellent Centers that demonstrate the university's strengths in aspects of environmental research: the recently reformed Center for Environmental Studies (anchored in humanities, architecture, and the interpretive social sciences) and the recently formed Carbon Hub (focused on one specific engineering challenge). Environmental issues are a latent part of a number of other campus institutes and centers, none of which are connected across campus, restricting the public visibility and impact of our scholarship. By foregrounding and connecting our currently fragmented environmental research, the Institute could rapidly support the growth of excellent environmental scholarship.

Several of Rice's Institutes have a high potential for collaboration on environmental problems. For example, the Kinder Institute for Urban Research includes housing, transportation, health, and urban resilience among their core issues. These four issues are directly related to environmental problems such as environmental justice and pollution. We also envision great potential for collaborations with the Baker Institute to solve environmental problems like energy transition from policy and economic perspectives. The Baker Institute's non-partisan model is one that Rice Environmental Institute would specifically seek to emulate in developing multidisciplinary solutions to environmental issues. Additionally, Rice Environmental Institute can harness the computational and technological strengths in the Ken Kennedy Institute by encouraging the application of data science and machine learning to environmental problems.

With an institutional locus for community environmental engagement, Rice will be able to immediately leverage our community's enthusiasm for environmental scholarship across the faculty, staff, and student body. Envirofac counts 140 scholars (including 90 tenure track faculty) who work on environmental issues (see adjacent figure) in its network. Interest in environmental outreach is also evident from the student population, with 20 student-formed clubs and committees that come under the umbrella of the Rice Environmental Society (RES is overseen by the Administrative Center for Sustainability and Energy Management at Rice). The Envirofac group and the Rice Environmental Society are the seeds for the university-wide platform that the Environmental Institute would provide, laying a strong foundation for its success.

FLOODING AND HOUSTON

On August 27 2017 Hurricane Harvey came ashore and parked itself over the city, dumping rain, for four days. The National Hurricane Center's assessment of the storm judged it to be "the most significant tropical cyclone rainfall event in United States history." The assessment tells the story of an unprecedented disaster from a relatively detached scientific perspective. Not mentioned in the assessment, however, was the damage it caused. 80,000 homes in the Houston area were flooded, 1 million vehicles were destroyed and at least 88 people died in the hurricane. The total monetary damage to the region was 125 billion dollars, doubling the amount of damage done by Superstorm Sandy.

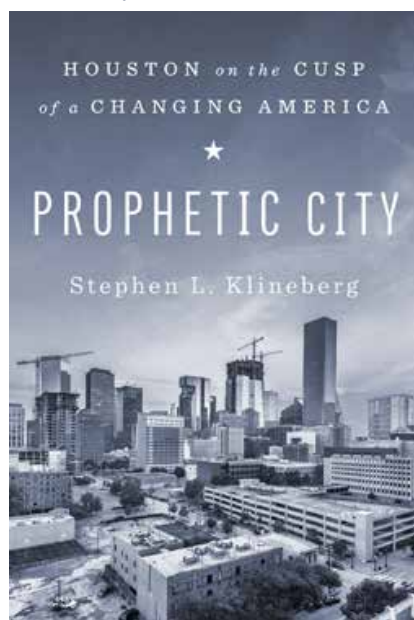
THE ENDURING IMPACT OF HURRICANE HARVEY: 2020 KINDER HOUSTON AREA SURVEY

1. The storm called Harvey was the worst rainfall event ever to hit the continental United States, but more than two and a half years have passed since the hurricane made Houston landfall in August 2017. The survey respondents were less likely in the 2019 survey than in 2018 to think spontaneously about storms and flooding when asked to name the biggest problem facing people in the Houston area; but the numbers grew back in 2020, indicating that area residents are still very much aware of the region's continued vulnerability.

2. More than three-fourths of the respondents in all three surveys said it was virtually certain that Houston will experience more severe storms in the next ten years compared to the past ten years, and they were only slightly less likely in 2020 than in 2018 to call for prohibiting any additional construction in flood-prone areas.

3. Harris County residents in 2020 were every bit as concerned as they were in 2018 about the impact of global warming, and they were more convinced than ever before that human activities, and not natural climate cycles, are the primary cause of climate change.

KLINEBERG, HOUSTON AREA SURVEY

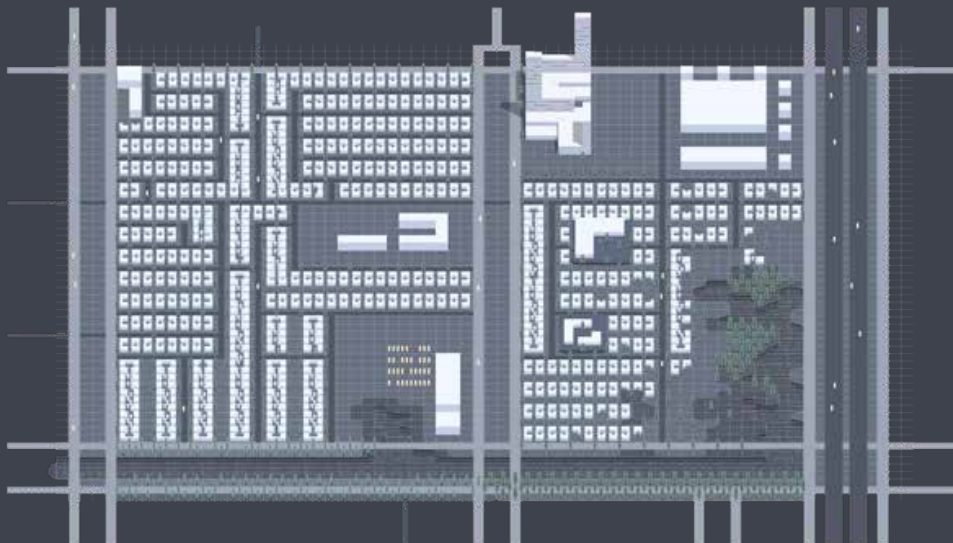


5.2 COMMUNITY ENGAGEMENT: A RICE STRENGTH

An Environmental Institute at Rice would be well-positioned to immediately engage with our community, building on Rice's successes in engaging our host city. This high level of community engagement is a Rice characteristic that an Institute can build on. For example, the Ion, the Kinder Institute, the Houston Education Research Consortium, The SSPEED Center, the Center for Civic Leadership, The Texas Policy Lab and the Rice Design Alliance highlight the deep ties between Rice and its Houston home. Through research, faculty have made deep commitments to Houston, a commitment mirrored by students who are actively engaged with many dimensions of the city (from energy, to preservation, to waste management and urban reform.) Finally, the university's alumni serve in all levels of local industry and politics, directly tying the university to the city. These connections will allow the Environmental Institute to become a strong regional partner, providing environmental policy solutions for our community.

ENVIRONMENTAL EDUCATION IN THE COMMUNITY: AN OPPORTUNITY TO STRENGTHEN RICE'S COMMITMENT TO DIVERSITY, EQUITY AND INCLUSION. Given Rice's strengths in educational outreach, the Institute will be well-positioned to develop environmental curricula for Houston-area schools, working in collaboration with the Rice Office of STEM Engagement (RSTEM), pedagogical experts in Humanities and Social Sciences, and a number of community partners. An example community partner is the Buffalo Bayou Partnership (BBP), which supports a large network of ADA-accessible public parks along Buffalo Bayou. The BBP and Rice boards of trustees have historically had overlapping membership which has historically smoothed collaborations. With BBP and disability advocate NGOs like the International Association for Geoscience Diversity, the Environmental Institute could develop a rich, ADA-accessible, outdoors field curriculum designed to introduce local K-12 students to key multidisciplinary environmental topics like the role of rivers in cities. The Institute could also engage K-12 schools who have already invested in multidisciplinary environmental education, a project that has strong overlaps with Rice's increased commitment to racial justice. For example, Furr High School in the Houston Independent School District has both environmental justice and gifted/talented magnet programs as well as an enrollment that is 98% underrepresented minority. Working with partners like Furr would build the university's capacity to address environmental issues through the lens of communities of color, a challenge that is particularly important to environmental scholarship.

PHASE ONE, 1ST DETENTION POND, TWO APT. BLOCKS



PHASE FOUR, SIX DETENTION PONDS, 8 APT. BLOCKS

FLOODPLAIN RECLAMATION

WORK AT RICE shows us that Houston has a problem. 187,498 structures, 28% of its building stock, is built within the post-Harvey 100 year flood plain. Given the near certainty that floods in this zone will occur at a much higher frequency than every hundred years. These structures were built within the natural floodplain of the bayou and will have to be removed.

If buyouts of these properties are only offered in response to actual flooding events, as is now the practice, they will be done at great cost to the owners and residents, the insurers and the regulating authorities. The alternative is a phased retreat from the floodplain. Planning for this inevitable retreat will insure that the affected neighborhoods will not only remain intact, but will prosper and grow as they are rebuilt in proper relationship to the bayou.

FLOOD PLAIN	TOTALS	PERCENT OF CITY
.1% FP	101,428	15%
.2% FP	86,070	13%
.1% +.2%	187,498	28%
OS .2%	469,634	70%
city	657,132	4.8

28% of Houston's building stock is built within the post-Harvey 100 year flood plain.

5.3 CIVIC ENGAGEMENT: HOUSTON AND RICE

The Institute envisions strategic engagement with the City of Houston to close the gaps between fundamental research and actionable plans for resilience, biodiversity and climate mitigation. Climate Action plans and resilience planning in the City of Houston are ongoing, acknowledging current and future threats to our built environment. Rice community members currently work with the city on these projects in an ad hoc way. We envision the Institute as the pre-eminent regional partner sought out for excellent advice, showcasing our ability to reach beyond the hedges to engage with the city and be a bridge to local and regional communities who are threatened by environmental challenges. The Institute would also empower community members working on relevant issues, providing them access to research and scholarly resources at Rice. Rice's faculty already maintain ongoing collaborations with the more than 100 local environmental groups listed by the Citizens Environmental Coalition, giving us a strong foundation to grow from.

THE ION

The Ion is a nucleus for innovation in Houston, fostering a community and culture where entrepreneurs and corporations come together to solve some of the world's greatest problems. This 300,000-square foot structure is designed to bring Houston's entrepreneurial, corporate and academic communities together into collaborative spaces and programs. The ION will anchor the 16-acre South Main Innovation District and is designed to become the epicenter for Houston's innovation ecosystem as an inclusive, dynamic, vibrant and highly dense hub focusing on quality collaborations between entrepreneurs, incubators, accelerators, corporations and the academic community when it opens in early 2021.

"We chose the name Ion because it's from the Greek *ienai*, which means go. We see it as embodying the ever-forward motion of discovery, the spark at the center of a truly original idea. It also represents the last three letters in many of the words that define the building's mission, like inspiration, creation, accel-

SOUTH MAIN INNOVATION DISTRICT



ION CENTER,

5.4 INDUSTRY ENGAGEMENT: A NEW VIEW.

Rice is located at the nexus of the national and international fossil fuel economy, giving us a special responsibility to pursue environmental solutions to the problems associated with our city's fossil fuel economy. The Institute will foster not only the development of concrete solutions to specific environmental problems, but it will do so through a thoughtful examination of humanity's relationship with the environment. Direct lines of communication between the university and industry leaders have long existed. The Shell Center for Sustainability funded environmental projects on the campus from 2002 to 2017. The Carbon Hub and the Rice Energy and Natural Resources Initiative (ENRI) are two recent examples of the University's collaborative efforts. The Carbon Hub, also funded by Shell, includes more than 70 researchers from universities, laboratories and research institutes across the U.S. In addition to Shell, the Hub aims to partner with other energy companies.

Over the years, individual collaborations between Rice faculty and Industry sponsors have been numerous. These collaborations are currently being complemented by another approach to industry that is often referred to as the Innovation Economy. The university's collaboration to create Houston's new Ion innovation district has been an exemplary initiative, attracting, among others, Greentown Labs, the largest climate technology and renewable energy incubator in North America. In a similar vein, Rice Environmental Institute will facilitate connections with old and new industries by establishing a dialogue between both existing and emergent energy industries and the university community. Rice's location in Houston allows us to directly participate in the re-envisioning of the relationship between energy and the environment as no other comparable research university can. With the new Institute facilitating this level of access, our scholars and students can affect real change in transitioning to a sustainable, low or post-carbon economy.

5.5 NATIONAL AND INTERNATIONAL ENGAGEMENT

Rice environmental scholars have broad-reaching national and international engagements (see global and national maps). Rice Environmental Institute would serve as a connection hub for scholars engaged in international environmental research and education. Furthermore, the Institute would work directly with the Vice President of Global and Digital Strategy to deepen and broaden Rice's environmental reach and impact. Europe, Latin America and Africa are especially promising areas for extending engagement, as Rice environmental scholars from multiple schools and departments already have research programs in place.

FACULTY PARTNERSHIPS AND COLLABORATIONS

Domestic NGOs

Environmental Defense Fund
Union of Concerned Scientists
The Nature Conservancy
Cary Institute of Ecosystem Studies
Audubon

National Environmental Organizations and Funding Agencies

Environmental Protection Agency
Department of Defense
Department of Energy
National Oceanic and Atmospheric Administration
U.S. Department of Agriculture
U.S. Forest Service
U.S. Fish & Wildlife Service
National Parks Service
NASA
Petroleum Research Fund

National and International Professional Associations

American Institute of Architects
American Geophysical Union
American Chemical Society

National, international and multinational corporation

Shell
Chevron
Exxon Mobil
Schlumberger
EDF Renewables
NRG Energy
Dao Chemical
DuPont

National and international museums

Houston Museum of Natural History
Raymond M. Alf Museum Museum of Paleontology

National and international biodiversity field sites

Intergovernmental Science-Policy Platform on Biodiversity
Harvard Experimental Forest
San Dimas Experimental Forest
Centre ValBio, Madagascar
Smithsonian Tropical Research Institute, Panama
Critical Zone Observatory: El Yunque National Forest
Kellogg Biological Station Long-Term Ecological Research
Sevilleta Long-Term Ecological Research Station

National and international conservation organizations

Conservation International
Wildlife Conservation Society
Belize Audubon Society
Friends for w and Development
United Nations Intergovernmental Science-Policy Platform

FACULTY PARTNERSHIPS AND COLLABORATIONS

TO THE LEFT is a list of known research and community outreach connections identified in a recent environmental faculty survey. Self-identified environmental researchers at Rice take part in multiple international educational organizations, international working groups, and collaborate with researchers at Universities throughout the United States and globally.



6.0 INSTITUTE STRUCTURE AND NEXT STEPS

Our vision is to promote sustainable and equitable systems that allow humanity and nature to thrive together. Here, we provide a concise set of design principles for a Rice Environmental Institute (6.1), as well as a path forward with action items for environmental research (6.2), education (6.3) and outreach (6.4).

6.1. INSTITUTE DESIGN PRINCIPLES

Following the environmental institute design recommendations of the Mitchell Report (Hoffman and Axon, 2017), a key goal should be to “raise all boats,” with the Institute acting as an integrating hub and amplifier for environmental initiatives distributed throughout the university. Rice’s environmental program can become more than the sum of its parts with one, coherent Institute integrating its dispersed entities and goals.

The Task Force recommends the following broad principles for Rice’s Environmental Institute. These principles can be used to develop a detailed design for the Institute in the months ahead.

1. The Rice Environmental Institute should promote multidisciplinary research projects built around diverse stakeholder partnerships. Environmental change is a multidimensional research problem that requires a fundamentally holistic approach, ideally integrating insights, methods and paradigms drawn from across academia. In its holistic ambition, the Institute would have the potential to fundamentally change how interdisciplinary research is conceptualized and executed at Rice, transforming how academia and other stakeholders can come together to address urgent societal problems.

- 2.. The Institute should organize around a “hub” and “spokes” model wherein new faculty hires have joint appointments and existing faculty are networked into the Institute as affiliates. The Institute will serve as a central resource hub and beacon for the rest of the University, while also supporting the “spokes” of individual Departments and Schools to expand their own capacity in the areas of environmental scholarship and teaching. The hub and spokes model should integrate the current excellent work within Rice’s Schools and platform cross-School coopera-

A TEXAS-FOCUSED SOIL CARBON MARKET

Led by senior environmental lawyer and Professor of the Practice at Rice, Jim Blackburn, an 80-member group representing 50 distinct entities is building a suite of scientific, economic, and policy tools to allow businesses to invest in the carbon stored in Texas landowners' soils. This Baker Institute project is building policy tools that will create a soil carbon market designed to spur innovation in Texas land use practices that will allow rural landowners to be paid for removing CO₂ from the atmosphere by building the soil carbon stocks on their property. Well-documented ancillary benefits occur when soil carbon increases, including reduced flooding, improved access to groundwater, reduced fertilizer pollution, and increased resilience of native ecosystems. Stakeholders include ranchers, farmers, Native nations, environmental NGOs, and multinational energy companies.



tions and initiatives. The hub and spokes model should also ensure that there is not a "one size fits all" approach to how each School engages with the Institute, since each School is very different in terms of structure and resources.

3. The Institute should design and foster novel environment-focused curricula and programs, which will build on, complement, and strengthen the successes Rice has already achieved in environmental education. The Institute should help integrate environmental education so that it is interwoven across all disciplines and programs throughout the University. The Institute's core pedagogical goal should be weaving environmental teaching and training deeply into the fabric of Rice's educational structure, from the undergraduate level to post-graduate education, from individual courses to certificates and joint degree programs.

4. In its outreach and engagement activities, the Institute should strive for bilateral exchange with the public, balancing knowledge creation with action. While academia can bring intellectual rigor and methods, it also needs to consider multiple perspectives and voices to ensure inclusive, relevant, and actionable results. Environmental crises are being faced head-on by communities around the world whose lives and societies have already been fundamentally changed by these evolving threats. Rice must not only value those efforts, but support and learn from them as well as establish deep and meaningful collaborations with these parties. Solutions - from capacity-building to policy recommendations - should not be considered without input from those that are most impacted.

5. The Institute should be solutions oriented. The multiple urgent environmental challenges of our times require nothing less. The Institute should facilitate direct engagement with stakeholders, helping new technologies, policies, and institutional approaches to solving environmental problems come to fruition.

At the same time, it is crucial to preserve the integrity of academic research, and especially to encourage multidisciplinary work without the pressure of immediate application, whether in the sciences or the humanities. The Institute should especially seek to develop solutions to the major environmental issues facing humanity that also promote principles of environmental justice, equity and inclusiveness.

6. The Institute should be dynamic and nimble so that it can adapt to the changing nature of both local and planetary problems. The impacts of environmental change will evolve as society mobilizes to meet its challenges, and the Institute will need to be fluid enough to evolve and adapt as problems and conversations change. This means finding ways to transcend bureaucracy; to continue to innovate when it comes to hiring, research, and educating; to enable new fields, topics, and discourse to emerge. The Institute should foster a sense of innovation such that it can help the University meet the new and complex challenges that will

arise as the conditions of environmental crisis change.

7. The Institute should strive for dedicated physical space but be mindful about not adding to the high carbon footprint and sprawl that characterizes most American university campuses. Given the breadth and diversity of environmental scholarship across the University, it is critical that the Institute provide a central gathering point where scholars and teachers can come together, collaborate, share knowledge and engage in strategic planning. At the same time, the Institute should epitomize Rice's new commitment to sustainability, which includes managing a built environment that does not simply grow opportunistically but that commits to the principle of reusing resources, including existing buildings and space, wherever possible.

8. The Institute should be anchored by a robust business model to ensure long term sustainability while meeting interim goals and the vast and growing public demand for high quality, reliable environmental information. The Institute's business model should seek to be as nimble and innovative as its organizational structure; blending external revenue streams from grants, foundations, industry and other partners will be key to the success of this endeavor.

These 8 principles outline a framework for moving forward. Although much can and will be accomplished by Rice faculty and administration, among the most important first steps toward realizing a Rice Environmental Institute will be hiring a start-up team. For example, in 2011, a year after the Kinder Institute was founded, the Institute had an Executive Director, two Project Administrators, a Research Scientist and a Web Developer on staff. Using this as a benchmark, we would advocate hiring a REI start-up staff during Y1 that would include an Executive Director (to develop and implement the strategic vision in collaboration with campus leaders), a Communications Manager (to work on the website and outreach), a Grants Specialist and a Program Manager (to organize events and assist with curriculum development and coordination). In addition to core staff hires, Y1 would be an excellent time to finalize an inclusive, cross-School faculty advisory council for REI.

The final sections of the report discusses additional next steps for bringing the Institute into being, focusing specifically on realizing the research, teaching and engagement goals outlined in earlier sections of the report.



ENVIRONMENTAL JUSTICE FELLOWS PROGRAM

It is clear that environmental problems disproportionately affect people of color, the poor, and residents of the global South. The disproportionate environmental burden experienced by disenfranchised people is an area of central concern for environmental scholars at Rice. It is also an area of great interest for our students, with the new environmental justice course on campus (ENST 301) filled for Fall 2020 with a substantial waiting list. The Institute proposes to work in conjunction with other Centers and Institutes to create an environmental justice fellowship program designed to attract internationally prominent scholars in the field.



6.2 RESEARCH: NEXT STEPS

TO EXECUTE INSTITUTE RESEARCH GOALS, WE PROPOSE:

PHASE 1 (YEARS 1-2)

Activities to facilitate collaborations to build excellence in environmental research:

- Maintain and expand the Sustainable Futures Creative Ventures Fund in order to provide seed funding for multidisciplinary projects ideally spanning multiple Schools.
- Create an Envirofac speaker series (six speakers per year, with staff support for implementation) to bring in high profile speakers of broad interest to grow momentum. Speakers would also include environmental institute leaders from other universities to learn about initiatives and successes/failures.
- Host two half-day high profile environmental conferences (one in the 2022-23 and one in the 2023-2024 academic years).
- Support monthly Envirofac social events to promote conversation among the faculty and administration about environmental research and to discover new areas of collaborative opportunity at Rice.

PHASE 2 (YEARS 3-10)

Allocation of resources for additional Personnel; Faculty and Staff, Student Funding

- Invest in multiple new tenure-track faculty lines in coordination with a the Rice Environmental Institute faculty leadership team
- Invest in new postdoctoral and graduate fellowships in conjunction with the founding of REI
- Develop a new Environmental Institute visiting scholars program
- Host an annual environmental symposium to highlight undergraduate and graduate research
- Allocate appropriate space for environmental research on campus in collaboration with the Schools

6.3 EDUCATION: NEXT STEPS

TO EXECUTE INSTITUTE EDUCATION GOALS, WE PROPOSE:

PHASE 1 (YEARS 1-2)

- Establish an environmental curricular council to meet twice a year to coordinate curricula across Schools, Departments and programs, identifying educational areas of opportunity, redundancy and working to ensure stability of core course offerings
- Coordinate and promote the Environmental Science major and Environmental Studies minor programs
- Issue a CFP to develop new interdisciplinary courses in environmental topics. "Partner courses" across departments will expose students to interdisciplinary approaches to understanding and solving environmental problems. Funds for graduate teaching assistantships should be a feature of these courses
- Compile information on existing environmental internship opportunities and expand them in collaboration with the Rice Office of Sustainability and Rice Center for Civic Leadership (<https://ccl.rice.edu>). Many faculty have personal connections to local businesses which have led to ad hoc environmental internships (e.g., Nature Conservancy, H-E-B Environment, local law firms). Leveraging these connections could jump-start a strong internship program without significant capital investment

PHASE 2 (YEARS 3-10)

- Rollout new undergraduate certificate programs in climate communication and environmental leadership (see 4.2 above)
- Rollout new graduate certificate in environmental education (see 4.2 above) and develop corresponding graduate training program in environmental scholarship and mentoring
- Rollout new Executive Education program in Energy, Environment, and Climate (see 4.2 above)
- Develop new field and outdoor enrichment programs targeting traditionally underrepresented groups in environment and STEM in collaboration with Houston community partners
- Offer seed funds for graduate students to help organize and mentor undergraduate research teams
- Create an annual green jobs fair and offer green career counseling services

6.4 ENGAGEMENT: NEXT STEPS

TO EXECUTE INSTITUTE OUTREACH GOALS, WE PROPOSE:

PHASE 1 (YEARS 1-2)

- Allocate resources toward data collection and database organization of existing Rice connections with non-academic stakeholders.
- Create a Rice Environmental Institute website building upon the existing Envirofac website (<https://trei.rice.edu>) and featuring a) a centralized listing of environmental lectures and activities on campus, b) a shared reading list to cross-pollinate perspectives, c) a database of community partners and projects and other connections and d) expanded faculty bios, information on environmental courses and degree programs

PHASE 2 (YEARS 3-10)

- Develop formal MOUs with the City of Houston and Harris County that allow Rice faculty and students to participate in local government efforts in projects of climate resilience
- Develop a network of long-standing environmental partnerships with key superneighborhood and community stakeholders, civic movements and NGOs in which Rice faculty and students work collaboratively with community members to design and realize environmental research and action initiatives
- Create seed funds specifically for enabling Rice-community partnerships in environmental problem analysis and remediation (e.g air quality, flooding)
- Create an Environmental Justice Fellows program with a preference for projects in the American South