SUSTAINABLE SOLUTIONS FOR PEOPLE AND THE PLANET

ENVIRONMENTAL SOLUTIONS INITIATIVE

$4.3-20.2 trillion per year

Value of lost ecosystem services due to land use change corresponds to a loss of 5-27% of total GDP per year[1]

1.5 billion *people could be climate refugees by* **2060**[2]

Today **more than half** *the global population lives in cities*[3]

Cities consume **75%** *of global energy and are responsible for* **50-60%** *of the world's greenhouse gases*[4]

Urban populations are expected to **double** *in the coming decades*[5]

To date, humans have produced **8.3 billion metric tons** *of plastic*[6]

More than **15M** *environmentalists in the U.S.* **do not vote** *regularly*[7]

1. Costanza et al 2014 | 2. Geisler & Currens 2017 | 3. UN 2014 | 4. unhabitat.org/urban_themes/energy/ | 5. UN 2014
6. Geyer, Jambeck & Law 2017 | 7. Environmental Voter Project

MIT's Environmental Solutions Initiative (ESI) advances science, engineering, policy and social science, design, the humanities, and the arts towards a people-centric and planet-positive future.

ESI pursues this mission by mobilizing students, faculty, and staff across MIT in partnerships for interdisciplinary **education**, **research**, and **convening**.

From declining fisheries to acute urban pollution to record-breaking global temperatures, the evidence of human impact on the environment continues to mount, and the urgent need for solutions continues to grow.

Scholars and students across MIT are committed to understanding, addressing, and reversing the negative effects of humanity's footprint on the Earth.

Global environmental solutions will draw not only from science, engineering, and technology, but from the full range of fields represented at MIT. ESI focuses its research, education, and convening programs on three priority areas:

- CLIMATE SCIENCE & EARTH SYSTEMS
- CITIES & INFRASTRUCTURE
- SUSTAINABLE PRODUCTION & CONSUMPTION

Highlights of ESI's work in these areas are featured on the following pages.

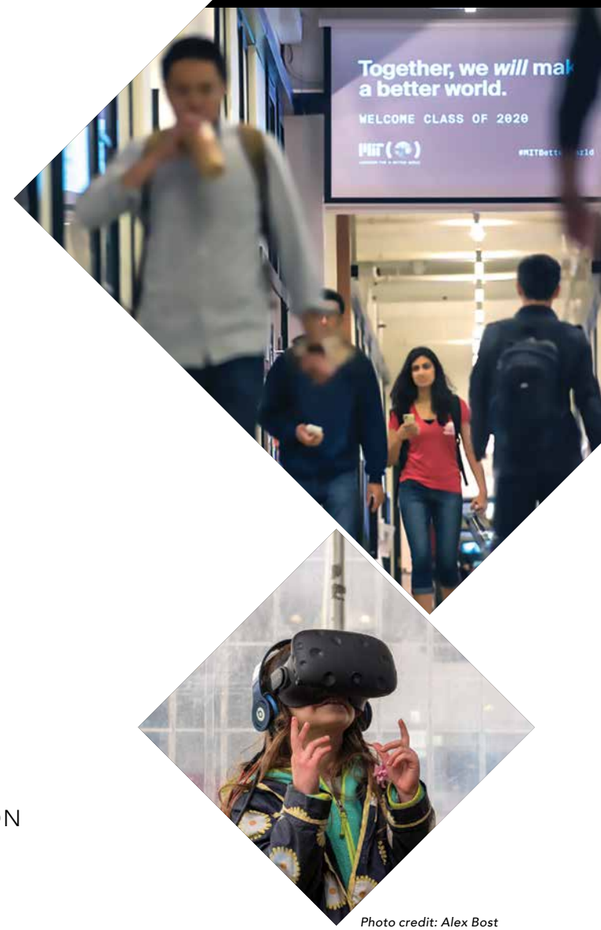

Photo credit: Alex Bost

"For more than a century and a half, MIT has been home as much as any place in this nation to the enterprise of science... In this, the era of climate change, we need more than ever the guidance and innovation of science to make the right decisions."

– Senator Sheldon Whitehouse

Founder of republicEn.org, Executive Director of the Energy and Enterprise Initiative ("E&EI") at George Mason University, and former U.S. Congressman (R-SC) Bob Inglis urged that free enterprise be harnessed to address climate change at a People and the Planet *lecture.*

Photo credit (large and inset): Casey Atkins

CLIMATE SCIENCE AND EARTH SYSTEMS

Rapidly progressing changes to our climate system have become a primary challenge to our species. These changes threaten entire regions and societies partly because we have become exquisitely attuned to the stability of the climate. Disturbances to that stability have already increased severity and frequency of extreme weather events, water and food disruptions, ocean acidification, and more.

Spotlight on ESI Convening

Developing effective solution pathways requires meaningful interaction among diverse perspectives. ESI's *People and the Planet* lectures bring thought-provoking speakers to the MIT community, including Senator Sheldon Whitehouse (D-RI) *(left)* and former Congressman Robert Inglis (R-SC) *(bottom left)*—both advocates for strong responses to climate change, with distinctly different ideas on how to get there. Student round tables, salon-style conversations, hackathons, and other interactive events (such as the "Advancing Conservation with Artificial Intelligence" workshop co-hosted with Conservation International and sponsored by the MacArthur Foundation; *photo below*) inspire and engage, sparking new collaborations, research questions, and shared learning.

Business interests joined conservation scientists and MIT faculty at the "Advancing Conservation with Artificial Intelligence" workshop.

Photo credit: Hannah Loomis

Top: Johan Rockström, director of the Stockholm Resilience Center and member of ESI's External Advisory Board, argued for "reconnecting the world economy to the biosphere" during his People and the Planet address.

Photo credit: Casey Atkins

CITIES AND INFRASTRUCTURE

With urban populations expected to double in the next few decades, the capacity of cities to produce and pilot sustainable innovations will continue to grow. The degree to which future waste streams, including carbon dioxide emissions, increase will be greatly determined by the technologies and engineering solutions deployed to serve urban needs.

Spotlight on ESI Education

Two urban waterways—the Mystic and Malden Rivers—are a learning laboratory for a new class supported by ESI: *"People and the Planet: Environmental Histories and Engineering."*

Digging deep into the past and present of local urban infrastructure yields fundamental insights into how human settlements impact human and environmental health and justice—and into how that knowledge can be leveraged to foster more sustainable cities. The class is required for an undergraduate minor in Environment and Sustainability, housed at ESI, which weaves together engineering, policy, science, history, and culture to equip students from all majors to help transform society.

Infusing climate and environmental content into introductory classes across MIT, supporting experiential learning both on- and off-campus, and illuminating diverse career trajectories are all part of ESI's commitment to embody MIT's *mens et manus* (mind and hand) approach to education.

"MIT faculty and students are partnering with us to apply sophisticated engineering, science and outreach to help understand the messy history and conditions of the local Malden River. These efforts are furthering the goals of restoring the Malden River for much-needed habitat, open-space, recreation, and economic development. This river will be transformed in the next five years—and an energized community and a cohort of MIT faculty and students will have played an important role in that transformation."

– Patrick Herron, Executive Director of the Mystic River Watershed Association.

John E. Fernández, ESI's director and professor of architecture, addresses EcoAmerica's 7th annual American Climate Leadership Summit at the National Press Club.

"We leveraged ESI funding to obtain valuable ship time for vital field experiments, putting ourselves at the forefront of environmental research that is supporting the mission of the International Seabed Authority to regulate future seabed mining activities."

–Thomas Peacock
Professor, dept. of Mechanical Engineering

SUSTAINABLE PRODUCTION AND CONSUMPTION

Adverse environmental consequences on humans and many other species—ranging from anthropogenic climate change to the Flint water crisis—result directly from energy and material extraction/generation and refinement, processing and production, and transportation and consumption. Transitioning these processes towards a more sustainable society will require building in new capacities to anticipate and minimize environmental and cultural harm.

Spotlight on ESI Research

The deep sea floor is home to vast untapped resources of minerals that have never been mined because of technological and economic challenges, as well as environmental concerns. Seventeen exploration licenses to investigate polymetallic nodules have now been granted by the International Seabed Authority, however, and preliminary mining activities may begin in the next few years. A multidisciplinary ESI research seed grant project led by MIT faculty Thomas Peacock, Pierre Lermusiaux, and Glenn Flierl is assessing, both empirically and theoretically, the potential environmental effects of deep-sea mining, focusing on the sediment plumes that will be created and their subsequent transport by ocean currents.

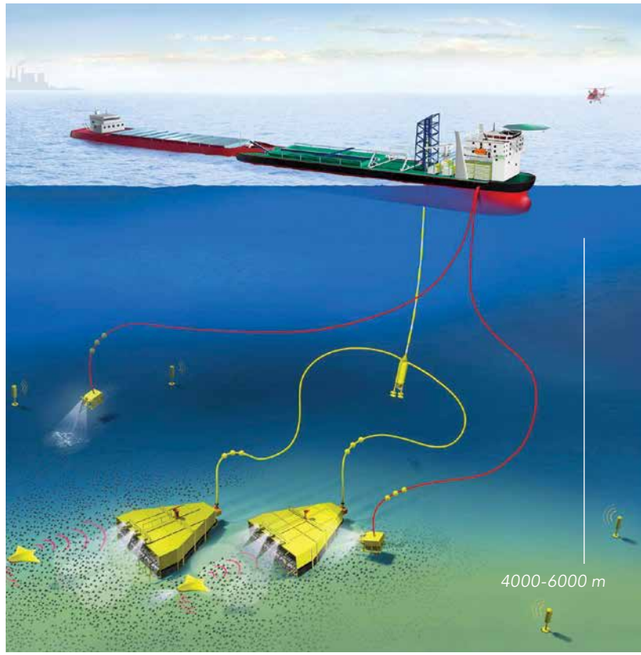

Illustration credit: Aker Solutions

Martin Fellows on retreat on Thompson Island.
Photo credit: Hannah Loomis

ESI's seed grant program has supported 15 exploratory projects to-date. Developing research areas include nature-based solutions to climate change, sustainable human settlements, and plastic pollution. ESI also hosts the Martin Family Society of Fellows for Sustainability, which supports advanced doctoral students across MIT engaged in a wide range of sustainability research topics.

SPOTLIGHT ON STUDENTS

MIT students have a profound interest in creating a more sustainable world. As emerging leaders, change agents, and innovators, they have already begun, and are hard at work at MIT growing their capacity and that of the society and organizations around them. Students are involved in everything ESI does; the stories on these pages are just a few examples of their initiatives and how they work with ESI.

UA Sustainability

MIT's Undergraduate Association (UA) Committee on Sustainability fosters green habits on campus by implementing waste reduction programs, such as installing composting within living groups, and providing resources for students seeking to live more sustainably. The committee also leads special projects such as an annual Trashion Show, dorm electricity competition, and Trash2Treasure program.

Trashion Show
A recent contestant shown left

GSC Sustainability Subcommittee

The Graduate Student Council (GSC) Sustainability Sub-Committee is a gathering point for climate-conscious, action-driven students to collaborate on implementing sustainable practices across the MIT campus. They launched The Reusable Revolution to increase awareness of disposable products, helped to develop an online Responsible Waste Disposal Practices course, and are currently working on a Carbon Awareness Program to raise awareness of campus CO_2 emissions and their effect on climate change.

Terrascope

First-year students at MIT have the option of joining the Terrascope Learning Community, a program that offers a unique curriculum, extracurricular activities, advising, and a community that explores environmental challenges together. With each new class of first-year students, Terrascope focuses on a different issue related to sustainability and Earth systems. Students work in teams in project-based classes, drawing on diverse perspectives, interdisciplinary research, and a supportive network of alumni, upperclassmen, and peers.

The *Climate Changed* Initiative

Led by MIT Architecture students, *Climate Changed* explores how climate-related models of the past, present, and future act in today's climate changed world. An ideas competition asks interdisciplinary teams to develop science-driven design interventions for a Boston-area site. An exhibition explores the history of climate modeling and its relationship to design. A symposium brings together multidisciplinary groups of scholars and experts to debate the use of climate models in design of the built environment. Co-sponsored by ESI and the MIT School of Architecture and Planning.

"The Environment & Sustainability minor taught me about the significant impacts of climate change, and empowered me to take action to try and mitigate the problem after graduating from MIT."

– Ishan Meswani, '18 Mechanical Engineering

"The support that Ashawari Chaudhuri (PhD candidate in History, Anthropology, and Science, Technology, and Society) received from ESI gave her much-needed time to synthesize what she learned during extensive fieldwork with farmers in India. Practically every time I saw her this summer, she expressed how grateful she was for the time to focus on her dissertation."

– Karen Gardner, Academic Administrator, Program in Science, Technology, and Society

Photo credit:
Ashawari Chauduri

"As one of the chairs of the UA Committee on Sustainability, I've enjoyed working with ESI on projects that affect undergraduate students and allow them to have a voice and impact in the larger discussion of how to mitigate climate change. The opportunities ESI provides allow undergrads to gain experience in research and policy fields that are usually inaccessible to such young students."

– Soma Mitra-Behura, '19 Materials Science and Engineering

"One of my favorite things about MIT is the incredible breadth and depth of expertise we have here. Many of the world experts in just about anything you're interested in are literally at your fingertips. It's a pretty unique opportunity to be able to speak with leading scientists in global climate, urban development, sustainable resource use, and any kind of engineering you can imagine, all in the same day by just walking down the sidewalk."

– Camrin Braun, Ph.D. Candidate
Biological Oceanography, MIT/WHOI Joint Program in Oceanography/ Applied Ocean Science and Engineering, 2015-16 Martin Fellow for Sustainability, National Geographic Young Explorer

Photo credit: Tane Sinclair-Taylor

ENVIRONMENTAL SOLUTIONS INITIATIVE

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