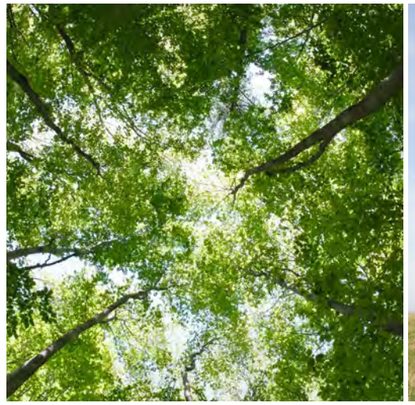

ENVIRONMENTAL
SUSTAINABILITY
IS STEM
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ENVIRONMENTAL SUSTAINABILITY IS STEM

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INTRODUCTION

What is environmental sustainability? Although definitions vary by source, at the core of each is the fundamental truth that our natural resources are in limited supply and if we do not approach the use and consumption of those resources in a sustainable way, we will eventually deplete and cause harm to the planet and all that inhabit it.

Human activities that contribute to climate change are non-sustainable activities. They alter the environment and all aspects of the planet we depend on. The young people of today and future generations, will be the worst affected by climate change and scarce resources, including water and food.

Pursuing global environmental sustainably is important because of how much energy, food, and human-made resources are consumed every day. Rapid population growth has resulted in increased farming and manufacturing, leading to more greenhouse gas emissions, unsustainable energy use, and deforestation. It's time to find ways to give back to the planet. To replenish and heal.

Science, Technology, Engineering and Math (STEM) are the keys to driving a more sustainable future from minimizing reliance on fossil fuels to minimizing waste and replenishing natural resources. In this ebook we explore a world of STEM-fueled solutions and pathways that can save our planet and the future of humankind.

We hope you accept the challenge.

— The STEMconnector Team



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ENVIRONMENTAL SUSTAINABILITY AND STEM

Environmental sustainability calls on our brightest minds and innovative thinkers to address the challenges of preserving our natural resources and minimizing the effects of global warming.

Across every sector, sustainability initiatives are growing in importance and scope. The number of people needed with the knowledge and skills to support environmental sustainability rose from 9.6% in 2015 to 13.3% in 2022 (38.5% growth rate), according to LinkedIn's new Global Green Skills Report.

The demand for filling sustainability or green jobs will continue to grow, being driven by governments and companies making commitments to reduce carbon emissions and achieve other sustainability goals.



TRENDING: GREEN JOBS

If Mother Earth was posting for a job opening it might read like this: looking for someone passionate about the environment and creating a better future for the planet. Positions located coast-to-coast in fields like ecology, biochemistry, meteorology, geology, and sustainability. Needed skill sets include research, analytics, and communications with a keen interest in STEM.

AIR QUALITY ENGINEER



Air quality engineers focus on maintaining clear indoor air quality or in remediating contaminated sites. Related tasks may include completing statistical modeling and ensuring that businesses comply with governmental regulations.

CHIEF SUSTAINABILITY OFFICER (CSO)



An executive-level position and one of the highest paying environmental jobs, this position requires years of experience and isn't an entry-level position. But given that CSOs help set corporate policy, it may be one of the most consequential.

CONSERVATION SCIENTIST



Though conservation scientists sound like generalists, they are one of the green job examples that has a very specific function and skillset. Rather than ensconcing themselves in laboratories, factories, or offices, they work largely outdoors. Their tasks typically include managing forests, including national parks, protecting at-risk habitats and assessing soil quality.

ENERGY ANALYST



These environmental professionals monitor energy markets, track energy data, make efficiency projections, and offer recommendations based on those projections.



ENVIRONMENTAL CONSULTANT

This investigative career can fit well with any number of fields. Why? Environmental consultants marry scientific knowledge with an awareness of the regulatory landscape to perform tasks such as identifying water, air, and/or land contamination, assisting with the implementation of green building practices, managing sustainability initiatives and so much more.



AGRICULTURE AND FOOD SCIENTIST

A broad professional discipline that touches virtually every area of our food chain, agriculture and food science involves examining every area of food production from field to factory so that consumers can feel confident putting fork to mouth, and the environment can stay safe.

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FOREST AND CONSERVATION TECHNICIANS

Forest and conservation technicians have much the same skill set as conservation scientists. However, they work almost exclusively with forests and any other natural resources that impact them.

ENVIRONMENTAL PROJECT MANAGER

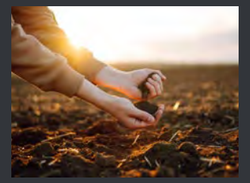
Offering consulting expertise, environmental project managers employ management skills to directly lead private companies in implementing environmental goals. Some of these may include setting and achieving corporate objectives, discussing applicable initiatives with relevant third parties, acquiring key personnel, using data to create informative reports for other decision makers, and more.

NATURAL RESOURCES SPECIALIST



This highly flexible job often ends up attached to governmental entities or universities, and employees monitor various environmental resources, examine environmental impacts, and make recommendations for restoring ailing areas.

SOIL SCIENTIST | PLANT SCIENTIST



Soil and plant scientists focus their efforts exclusively on managing crops, deterring pests, studying soil characteristics and composition, and ensuring that cultivation practices do not harm the environment.

GEOSCIENTIST



Geoscientists are highly educated (usually with a master's degree) and conduct primary research that's disseminated to other professionals, used by private companies, or received by governmental entities.

HYDROLOGISTS



Hydrologists study the way in which water moves throughout the environment, determine its current cleanliness, determine risks that may lead to pollution, and provide action plans. Hydrologists find work with both public and private employers.

RENEWABLE ENERGY CONSULTANT



Renewable energy consultants help interested clients or employers to understand their current energy requirements and how they can best add renewable energy sources into their power mix.







SAMSUNG'S SOLVE FOR TOMORROW

Samsung's annual Solve for Tomorrow Contest empowers thousands of students across America to create innovative solutions that transform local communities. Since the beginning of the program, students have turned their STEM (science, technology, engineering, and math) talents towards addressing environmental issues that they personally witness every day.

Each year Samsung hosts a $2 million national competition for public schools grades 6–12 in which students are asked to consider how science, technology, engineering and math (STEM) can be used to create change in their communities. With the help of their teachers, students can apply to the contest and compete to win up to $100,000 in prizes for their school, plus the opportunity to work with Samsung employees to develop their prototypes.

Check out these Solve for Tomorrow innovations that focus on natural resources, climate change adaptation, circular economy, wildlife, and a whole lot more.

WILDFIRE RISK DETECTION

In 2019 in California alone, 6,200 fires ravished the Pacific coast, 2,300 buildings were destroyed, and more than 100 people were killed. The majority of fires in California are caused by dry hills surrounding suburban areas and slow relay of information to the fire department. The students of Dougherty Valley High school in San. Ramon, created a low-cost sensor that can detect wind speed, humidity, and temperature, indicating a possible risk of fire in a particular area, and relaying that information back to the local fire department early.

FLOOD MANAGEMENT

Flash Flooding is the leading cause of weather-related deaths in the U.S. The city of Doral receives large amounts of precipitation especially during summer and hurricane season, but sediment obstruction and poor drainage have led to drainage system failures and flooding. The students of Downtown Doral Charter Upper School in Doral, Florida created a device to detect sediment build-up and share real-time updates on the density of sediments in drains to local officials when structures need immediate cleaning and maintenance.

GARBAGE APP

An estimated 25% of recycling is contaminated by waste, making cross-contamination a tremendous problem for recycling centers across the country. The students of North Carolina School on Science and Math in Durham, North Carolina created an app that uses image processing and machine learning algorithms to help people separate recyclables and non-recyclables.

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THE ENVIRONMENTAL DEFENSE FUND

Environmental Defense Fund (EDF) is a United States-based nonprofit environmental advocacy group. EDF's mission is to preserve the natural systems on which all life depends. Guided by science and economics, they find practical and lasting solutions to the most serious environmental problems.

The group is known for its work on issues including global warming, ecosystem conservation and restoration, oceans, and human health. Some of the most prominent causes are reducing global methane emissions, transitioning to clean energy, sustainable fishing practices, transforming retail supply chain methods to reduce exposure to toxic chemicals and habitat restoration with reciprocal benefits for at-risk species and landowners.

CLIMATE CORP FELLOWSHIP PROGRAM

The mission of the Climate Corps Fellowship program is to train talented and passionate graduate students and pair them with companies and public institutions determined to meet their climate and energy goals. Ultimately, the program alumni comprise a promising network of climate leaders to accelerate a clean energy future for all.

The fellowship program typically takes place in the summer, and students work on designing tools to accomplish emission reduction goals through energy consumption reduction, procuring renewable energy, electrifying fleets, and engaging suppliers on emissions reduction strategies.

Since the program first began in 2008, over 1200 graduate students have been placed in more than 540 leading organizations spanning the U.S., China, and India. Together they have helped identify energy savings worth more than $1.6 billion, the equivalent of over 2.2 million metric tons in carbon emissions.

EDF IMPACT AND INFLUENCE: WALMART

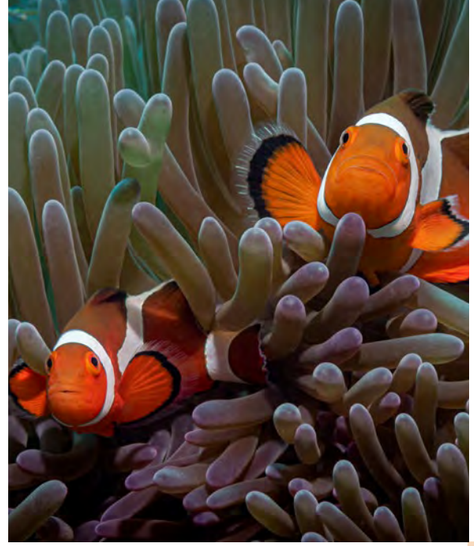
Environmental Defense Fund began its partnership with Walmart by helping them to create sustainability goals. This symbiotic relationship combined EDF's expertise in science and economics with Walmart's size, influence and desire for innovation, to create a more sustainable future for the company. At the time, 90% of Walmart's greenhouse gas emissions were coming from its enormous supply chain. After implementing more sustainable methods of production, Walmart was able to reduce their supply chain emissions by 20 million metric tons at the end of 2015. EDF continues to work with Walmart's supplier network to help the company achieve its ambitious goals outlined in Project Gigaton. The company aims to cut a billion metric tons of GHGs in its supply chain by 2030. EDF also helped Walmart create a first-of-its-kind chemicals policy that led to the phasing-out of eight chemicals of concern in more than 10,000 products.

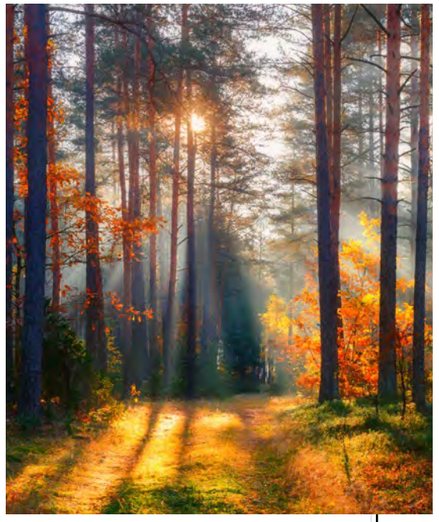
FEDEX

EDF worked with FedEx to help alleviate the carbon emissions created by hundreds of thousands of delivery trucks. This resulted in the creation of the world's first commercially successful hybrid delivery truck, which emits 96% less soot, 65% less smog-forming pollution, reduces greenhouse gas emissions by 33% and goes approximately 50% farther on a gallon of fuel. Presently, FedEx has continued its commitment to sustainability and plans for its pickup and delivery fleet to include only zero-emission vehicles by 2040.

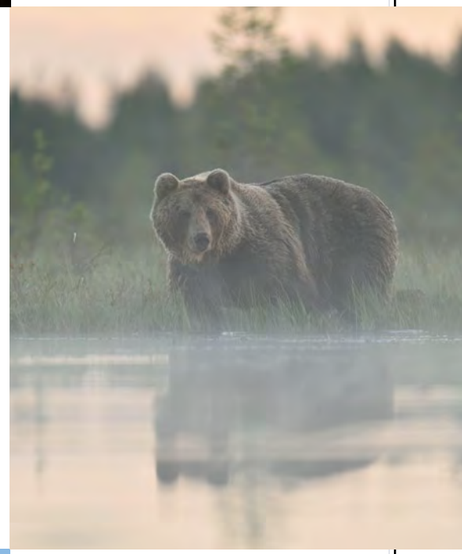
MCDONALD'S

In 1990, the Environmental Defense Fund and McDonald's collaborated in one of the first partnerships between an environmental group and a leading corporation. EDF's partnership with McDonald's scrapped the use of foam-plastic sandwich boxes and eliminated 150,000 tons of packaging waste over the course of ten years. Subsequently, this project inspired other large restaurant chains to follow suit.





> "To fight climate change, we need to do more than stop climate pollution. We need to reverse it."
>
> *— Environmental Defense Fund*







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CLIMATE ACTION AND ESG REPORTING MANAGER



Erin McNichol

HP

WHAT WAS YOUR PATH TO THIS ROLE?

I always knew I wanted to work in sustainability. At U.C. Davis I worked for the Recycling Program and wound up adding on Environment Policy & Planning as a minor as a result. I thought it was just a hobby, but was lucky enough to get a job in the field right out of college focused on the waste industry. I also worked for San Mateo county for a few years and realized that while I really loved working with a local organization and having that local impact, what I really wanted was to work in the private sector and make a larger impact in a faster-paced, global setting. I went back to get my MBA at Presidio Graduate School and was able to apply that along with my fellowship with the Environmental Defense Fund towards my current role.

WHAT'S YOUR ADVICE TO SOMEONE INTERESTED IN A ROLE LIKE THIS?

One question I don't get asked a lot is about salary. One thing I want students to know is that it is possible to have a financially viable career in sustainability, you don't have to choose sustainability over financially rewarding employment. I've seen people choose a career path outside of this field because they don't believe it's viable long term, but it's been my experience with and before HP that you can have a salary that's consistent with your education and experience. I'm a BIG believer in do what you love and the money will come!

SUSTAINABILITY MANAGER



Aaron Schreiber-Stainthorp

Jackson Family Wines

WHAT WAS YOUR PATH TO THIS ROLE?

After graduating from Kogod School of Business at American University with a Masters in Sustainability Management I was accepted as an EDF Climate Corps fellow and was able to put my experience to use as a fellow for Jackson Family Wines.

Once I started working in the wine industry, I never looked back. It had been the most fun I'd ever had at work, and the most work I'd ever done. When my fellowship was over I had the opportunity to lead sustainability efforts with Francis Ford Coppola for two years. When my old manager from Jackson Family Wines had a new opening, I jumped at the chance to return. My manager has been a true mentor to me for years and has really supported my growth in the industry since the beginning.

WHAT IS YOUR FAVORITE PART OF YOUR JOB?

One of the things I love about working in sustainability in general is that a lot of the initial concepts are deceptively simple, but as you dive into implementing them, you need to constantly learn and adapt to make initiatives successful, and it's fascinating where that takes you. For example, I came to this job with almost no knowledge of carbon sequestration and now it's a big part of what I do.

There are so many things I love about my job specifically, but I think my absolute favorite is that I get direct contact with the wonderful people who work on site every day. I also love that Jackson Family Wines has been very data driven about sustainability.

DIRECTOR OF GOVERNMENT AFFAIRS



Lillian Mirviss

Center for Sustainable Energy (CSE)

WHAT WAS YOUR PATH TO THIS ROLE?

I've always been really interested in energy. In college I interned at the California Energy Commission (CEC) and the Governor's office and got to work on some high-level policy work. At the CEC I learned about nuclear policy and at the Governor's office I focused on distributed energy resources. I then went to graduate school and was an Environmental Defense Fund Climate Corps fellow at Gap Inc., where I learned a lot about renewables.

After grad school I was looking into jobs in energy storage and OhmConnect popped up on my LinkedIn feed. The CEO had posted an article, a friend of mine had liked it, and that friend was able to connect me to the CEO. It was a great fit culturally and professionally, and I was excited about the opportunity to work in a startup and wear a lot of hats and work on many different aspects of energy. At OhmConnect I fell in love with the policy space and moved to a purely legislative role at Center for Sustainable Energy.

SENIOR ASSOCIATE, ESG SERVICES



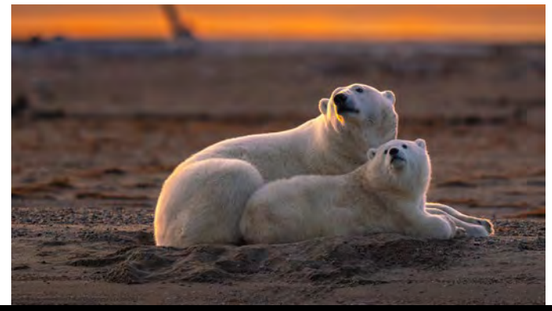
Alistair Hall

WHAT WAS YOUR PATH TO THIS ROLE?

I graduated from Vassar as an urban studies major, then went into a one-year program called GreenCorps, which is essentially an environmental advocacy boot camp. I picked up some great skills but it was one of the hardest things I've ever done. As that was wrapping up, one of my advisors reached out to let me know that Vassar had created an entry level contractor position in sustainability. In the spirit of intrapreneurship, I continued to build the position over the following six years into a fully fledged Office of Sustainability. While completing my MBA in Sustainability at Bard College, I spent a summer as an EDF Climate Corps fellow with PCC Markets in Seattle. As I had been mostly self-taught to-date with a lot of on the job learning, through Climate Corps I got to learn firsthand from organizations and professionals who have been in the field much longer. These varied experiences provided me with the knowledge and skills needed to transition into ESG Consulting.

WHAT'S YOUR ADVICE TO SOMEONE INTERESTED IN A ROLE LIKE THIS?

Any job can be a sustainability job even if sustainability isn't in the job title or description. There is huge potential in roles like marketing, finance, supply chain, or operations to apply a sustainability lens. Sustainability skills are something you can learn on the job and apply and leverage them to whatever you're already working on.





"I've been a sustainability professional for over ten years. In that time, I've seen enormous growth in both the number and variety of jobs that fall under the sustainability umbrella. The public, nonprofit and private sectors have all changed their attitudes and perspectives on what it means to operate responsibly, and entrepreneurs are seizing the opportunity to create new products, services, and even industries.

Life opens up when you finally find a job that lets you live your values and drives you to work harder to make a bigger impact. The trick is that finding and getting those jobs can be incredibly difficult if you're new to the space. I remember just how hard it was to get my first role in sustainability, and I've created a business centered around making that journey easier for others."

— Trish Kenlon

Founder, Sustainable Career Pathways

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NASA SUSTAINABILITY BASE

> Through a combination of NASA innovations and commercially available technologies, Sustainability Base leaves virtually no footprint. The project is proof not only that this level of sustainable building is possible, but also that it is imperative for the health of our planet."
>
> — *NASA*

In 2007, NASA held a "Renovation by Replacement" competition designed to replace antiquated and inefficient buildings with new, energy-efficient buildings. Each of the agency's ten centers submitted proposals to build a new facility, and Ames Research Center won the contest.

Dr. Steve Zornetzer, associate center director for NASA Ames, had the idea to implement the closed-loop technology NASA uses to sustain life in space and set out to design a building that minimized its environmental impact by harnessing both space technology and the natural environment.

NASA has decades of experience in creating human environments that promote optimal functioning. For astronauts to do their jobs, they must be at peak function, mentally and physically. Everything in their environment is designed to support that. Similarly, Sustainability Base, as the building was named, was created with the vision that everything about the design would support both human and planetary well-being.

NASA's Sustainability Base is both a working office space and an evolving exemplar of sustainable design. It showcases how technology, and the environment can thrive together in harmony. It's a building immersed in natural daylight and fresh air; one constructed to LEED Platinum standards and furnished with materials that are beneficial to employee health. A building so smart and intuitive it knows exactly how much energy is consumed – and adapts itself based on weather, season, and work patterns.

Learn more about NASA's sustainability initiatives here.

PROFESSIONAL SPOTLIGHT:

Dr. Tahani Amer

Program Executive at Earth Science Division of Science Mission Directorate

Tahani Amer discovered her natural passion and inclination for engineering while watching her father fixing his car's engine as she sat inside her small Egyptian apartment. While her love of math created a clear path for a mechanical and aerospace engineering future, it was great teachers and her father that encouraged and guided Dr. Amer. In return, she spends a great deal of her time to inspire and challenge young women to reach their potential. Dr. Amer started working at NASA in the Computational Fluid Dynamics (CFD) Branch. By working in this branch, she gained valuable experience and fulfilled her dream to work with scientists and researchers in solving real-life problems.

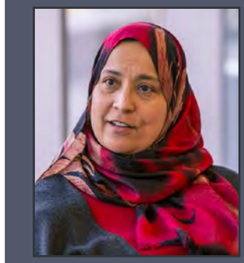
Q What first sparked your interest in space and science?

A I have loved science, mathematics, and chemistry for as long as I can remember – and I was good at all of them! When I came to the U.S. and took my first advanced calculus class, I could not speak a word of English, but I still earned an "A" in the course. I knew then that an engineering career would be rewarding, full of problem-solving and unlimited potential for innovation. I have always been passionate about learning the secrets of the universe, life beyond planet Earth, and what we need to do to protect and improve life on our home planet.

Q How did you end up in the space program?

A I had an internship with NASA as an undergraduate student through the Virginia Space Consortium, which led me to graduate school, and then ultimately a job at NASA's Langley Research Center. I started my career in aeronautics, space science, then technology development, and now Earth science.





> Math was, and is, my favorite subject. I recognized early on that math provided an opportunity to find new methods for solving problems by using math models."
>
> — *Dr. Tahani Amer*
>
> *Program Executive at Earth Science Division of Science Mission Directorate at NASA Headquarters*



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NASA SUSTAINABILITY BASE

Dr. Tahani Amer continued

Q Tell us about your job at NASA.

A I'm a program executive in the Science Mission Directorate (the part of NASA responsible for science) at NASA Headquarters in Washington, D.C. I also serve as a technical and programmatic expert for complex agency aerospace programs, supporting NASA's Earth Science Division. I manage engineering project planning for the development of spacecraft, instruments, and ground systems. My current missions include the Surface Water and Ocean Topography (SWOT), Geostationary Carbon Cycle Observatory (GeoCarb), and Atmosphere Observing System (AOS) missions.

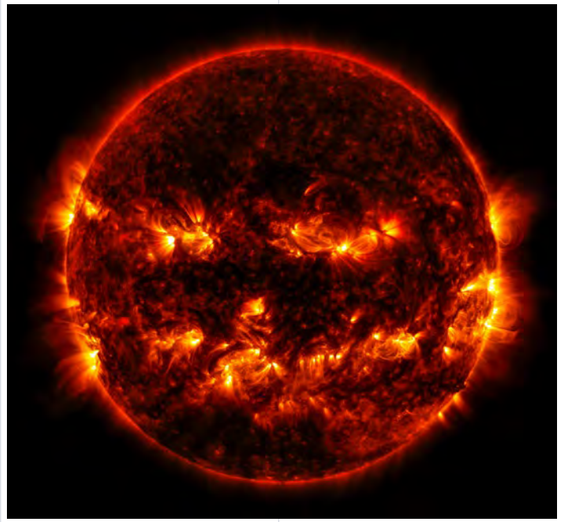
Q What's one piece of advice you would give students interested in pursuing a STEM career?



A I have a formula that I call my Equation of Success . . . [create a visual of: (IP3 + R)/T [Imagine your future x (Passion x Plan x Perseverance) + Relationships] / Time.









SHE'S ON A MISSION...MAKE THAT 3! DR. AMER'S MISSIONS AT NASA

SURFACE WATER AND OCEAN TOPOGRAPHY (SWOT)

The SWOT mission brings together two communities focused on a better understanding of the world's oceans and its terrestrial surface waters. U.S. and French oceanographers and hydrologists and international partners have joined forces to develop this satellite mission to make the first global survey of Earth's surface water, observe the fine details of the ocean's surface topography, and measure how water bodies change over time. **Learn Here**

GEOSTATIONARY CARBON CYCLE OBSERVATORY (GEOCARB)

The primary goals of GeoCarb are to monitor plant health and vegetation stress throughout the Americas, and to probe, in unprecedented detail, the natural sources, sinks and exchange processes that control carbon dioxide, carbon monoxide and methane in the atmosphere. The NASA-directed mission will launch on a hosted satellite to make observations over the Americas from an orbit of approximately 22,000 miles above the equator. **Learn More**

ATMOSPHERE OBSERVING SYSTEM (AOS)

The Atmosphere Observing System (AOS) mission goal is to optimize how we examine links among tiny particles known as "aerosols," clouds, atmospheric convection, and precipitation. AOS will deliver key data for improved forecasts of weather, air quality and climate. How? By providing unmatched insight into the vertical structure of our atmosphere with observations from space, our skies, and on the ground. **Learn More**

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NASA EMPLOYEE PROFILES



Claudia Sales

X-57 Deputy Chief Engineer

Claudia Sales currently works at NASA as the X-57 Deputy Chief Engineer. As the Deputy Chief Engineer, she is part of the technical leadership team, which ensures the project accomplishes the established research objectives. The X-57 project aims at achieving two goals that support sustainable aviation: 500% improvement in energy consumption at cruise and zero in-flight emissions. X-57 will demonstrate how electrification of airplanes can enable novel aircraft designs that will achieve higher performance efficiencies and lower emissions than the current state-of-the-art.

Claudia Sales received a Bachelor of Science in Mechanical Engineering in 2004 from the University of Texas at El Paso. Upon graduation, she accepted a job offer in the structural dynamics group within the Aerostructures Branch at NASA's now, Armstrong Flight Research Center, where she supported a wide variety of Aeroelastic ground and flight testing of unique test



articles and flight experiments. In the fall of 2017, she transitioned into the Systems Engineering and Integration (SE&I) Branch, where she became Chief Engineer for Phase Three of the Acoustics Research Measurements (or ARM3) on Armstrong's Subsonic Research Aircraft Testbed (SCRAT). ARM was another NASA project that supported sustainable aviation objectives by retrofitting a Gulfstream III aircraft with noise reducing hardware installed on the landing gear and landing gear cavities. Installation of the noise-reducing hardware smooths the flow around the landing gear area, which reduces noise emissions as well as reduces fuel consumption. Technologies that affect smooth flow on various aircraft structures are another research area being investigated in support of sustainable aviation. At the completion of ARM3, she continued in the SE&I branch to transition on to NASA's first electric X-plane, X-57.









Lauren Wibe

Civil Servant – Environmental Protection Specialist
Sustainability Program Manager
NASA Ames Research Center



Lauren Wibe is a civil servant at NASA Ames Research Center managing the sustainability program within the Environmental Management Division. She oversees the work of contractors and manages efforts to measure and improve the sustainability of the center. The sustainability program at Ames Research Center works to manage energy and water efficiency, sustainable buildings, fleet management, sustainable acquisitions, waste diversion, and greenhouse gas reduction. The center has a variety of testing and research that requires consideration of sustainability and the environment. She coordinates with operators, engineers, facility managers and various other staff that are involved in these areas to find issues, ways to improve, and ensure compliance with federal requirements. Civil servant duties include reviewing reports from contractors, finding information that they need for their responsibilities, making sure they are meeting deadlines and doing the required work with quality.

Before her career at NASA, she interned for the Bureau of Reclamation and learned about Hydrology and Water Resource Management in River Operations for the Lower Colorado Region in Boulder City, NV and the engineering branch in Phoenix, AZ. As an undergrad, she participated in a variety of activities to learn about many aspects of sustainability including honor's research in water treatment, the DOE Collegiate Wind Competition, and The ELECTRI International Green Energy Challenge.

She started working at NASA Ames as a Pathways intern in 2018. She received her Bachelor's degree in Civil Engineering from Iowa State University in 2019 and was converted to a full position at NASA Ames. She was awarded the Ames Graduate Fellowship in 2020 and completed her Master's in environmental engineering at Stanford in 2021. She has taken the Fundamentals of Engineering Exam and the Professional Engineering Exam and is in the process of getting her Professional Engineer's License.

Dr. Bridget Noreen Seegers

NASA lead on the Cyanobacteria Assessment Network (CyAN)



Dr. Seegers is a NASA lead on the Cyanobacteria Assessment Network (CyAN) project with the goal to validate a cyanobacteria algorithm for US inland waters. Cyanobacteria are an economic and human health problem impacting drinking water and recreational activities. Dr. Bridget Seegers is a swimmer, surfer, and sailor that loves water and has focused her research on water quality. Dr. Seegers is a NASA lead on the Cyanobacteria Assessment Network (CyAN) project with the goal to use satellites to help monitor for harmful cyanobacteria that are an economic, environmental, and human health problem. Cyanobacteria are microscopic bacteria that use sunlight to grow and can impact drinking water and recreational activities by creating toxins that make water unsafe. The satellites travel around the world everyday gathering data about the planet. That satellite data can alert water managers when there is a cyanobacteria problem, so they can respond and help keep people safe and healthy. The 20-year time series of satellite data adds to understanding about water quality changes overtime and insights into actions that can improve conditions or keep the water clean.

Dr. Seegers grew up near a small town in Wisconsin spending a lot of time in lakes. She studied Biology in college along with Environmental Science and Technology. After college she taught six years in a range of non-traditional classroom settings from the woods of Minnesota to inner city Boston as an AmeriCorps volunteer and at a charter school and an aquarium in San Diego. She returned to school earning a M.S. in Water Resources Science as she was interested in the science and policy interface. Then, during her PhD she combined in situ data with satellite remote sensing to better understand regional ocean dynamics and events such as harmful algal blooms. As an oceanographer she has worked much off the California coast on research cruises and with research robots called gliders. Dr. Seegers is passionate about outreach and education giving talks and hosting engaging events to excite people about science.

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SUSTAINABLE SOLUTIONS



National Carbon Capture Center

© National Carbon Capture Center

CARBON CAPTURE AND STORAGE

Capturing CO2 from the air and sequestering it long-term is known as carbon dioxide removal or CDR. The Intergovernmental Panel on Climate Change (IPCC) highlighted if we are to achieve the ambitions of the Paris Agreement and limit future temperature increases to 1.5 degrees, we must do more than just increasing efforts to reduce emissions - we also need to deploy technologies to remove carbon from the atmosphere.
Carbon capture, utilization and storage (CCUS) refers to a multi-stage process that allows carbon to be captured, removed from the atmosphere, safely stored and recycled for use in commercial products or services. Carbon capture is a complex process that involves the development of sorbents, designed to bind to CO2 particles to extract them from the atmosphere. Once these particles are captured, they can be utilized to produce a variety of products and services.

GREEN BUILDING AND CONSTRUCTION

Green building involves the design and construction of structures in a manner that offsets or eliminates any harmful environmental impacts often caused by the building process. Green building incorporates several practices, such as the efficient use of existing resources like water and energy, the use of solar and other renewable energies and the employment of nontoxic, ethical materials. A variety of careers exist within the green community space, including roles in sustainable construction, architecture, energy advising, finance management, sustainability analysis and community outreach. Whether you are working to construct a sustainable community from the ground up, to maintain one and uphold its principles, to manage community operations, or to strategize expansion of sustainable communities globally, the opportunities for a career in this expanding field are endless.

> “You cannot get through a single day without having an impact on the world around you. What you do makes a difference and you have to decide what kind of a difference you want to make.”
>
> *—Jane Goodall*







SUSTAINABLE MANUFACTURING is the creation of manufactured products through economically sound processes that minimize negative environmental impacts while conserving energy and natural resources.



BIOMANUFACTURING is the process of using living systems, particularly microorganisms and cell cultures, to produce biological molecules and materials on a commercial scale. This enables new technologies to manufacture chemicals essential to modern life in ways that are decoupled from fossil fuels. New alternative biomanufacturing routes promise the opportunity to convert sustainable carbon containing feedstocks, such as food waste and even CO2, into everyday essentials.

> “The Earth is a fine place and worth fighting for.”
>
> *—Ernest Hemingway*

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GREEN POWER



Green Power is a subset of renewable energy. Green Power is a term used to represent renewable energy sources with the most favorable environmental benefits. Green power comes in many different forms: solar, wind, geothermal, biogas, and hydroelectric sources. The only requirement to qualify as green power is the energy source must exceed the requirement for that resource and cannot produce pollution. Meaning green power is voluntary and something customers, can choose. Green power is sought after for being zero-emissions and for minimizing the carbon footprint.

SOLAR

This common, renewable, green energy source is a household name. Solar energy is produced using photovoltaic cells that capture sunlight and turn it into electricity. Solar power can be used to heat homes and buildings, for cooking and all domestic purposes. It is affordable and can be used on a larger scale.

WIND

The terms “wind energy” and “wind power” both describe the process of using wind to generate mechanical power or electricity. This mechanical power is commonly used for tasks such as grinding grain or pumping water. Wind power can be converted into electricity. Wind power is cost effective, doesn’t pollute the air and the nation’s wind supply is abundant and inexhaustible. According to government research, over the past 10 years, U.S. wind power capacity has grown 15% per year, and wind is now the largest source of renewable power in the United States.

GEOTHERMAL

To understand this type of green power we have to dig a little deeper, literally. Geothermal energy uses thermal energy stored under the earth’s crust. While this resource requires drilling to access, creating an environmental concern, it is without question a huge resource. Geothermal energy is what keeps hot springs warm, and what allows steam to turn turbines and generate electricity. According to data, the energy stored under the United States alone is enough to produce 10 times as much electricity as coal currently can.

BIOFUELS

First generation biofuels are made from sugar, starch crops (corn, sorghum), oilseed crops (soybean, canola), and animal fats and converted through a fermentation process to form bio-alcohols, including ethanol, butanol, and propanol. According to global energy statistics, just 2.7% of the world’s fuel for transport comes from biofuels, although biofuels are estimated to have the capacity to meet over 25% of global transportation fuel demand by 2050.

BIOMASS

Biomass power plants use wood waste, sawdust, and combustible organic agricultural waste to create energy. While the burning of these materials releases greenhouse gas these emissions are still far lower than those from petroleum-based fuels.

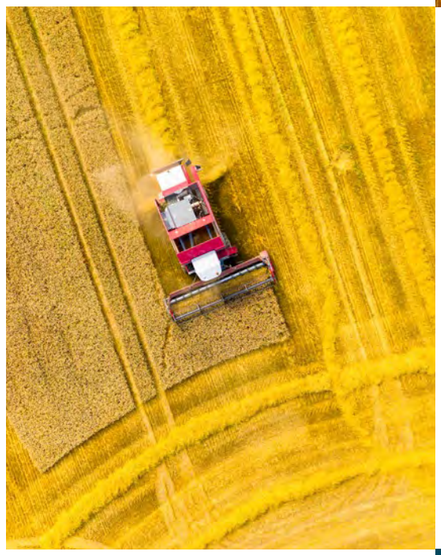
HYDROELECTRIC

Known as waterpower, hydroelectric power, is a type of green energy that uses the flow of water in rivers, streams, dams, or tides in the oceans to produce energy. No body of water nearby? Hydropower works on a small scale too using the flow of water through pipes in your home, or from evaporation and rainfall.









> “The environment is where we all meet; where we all have a mutual interest; it is the one thing all of us share.”
>
> — *Lady Bird Johnson*









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ELECTRIC TRANSPORTATION



The industry once heavily criticized for its pollution and reliance on foreign fuels is now putting the pedal to the metal on driving the force for change. The new fuel for the automobile industry is electricity.

Electric transportation is helping the world enter a new era of clean energy. It is estimated that nearly 30% of emissions come from transportation. Making the switch to electric will not only cut emissions it will help reverse climate change.

Drivers of electric vehicles spend the equivalent of about $1.20 per gallon, based on average residential electric rates. The trends indicate the future is electric. EEI (Edison Electric Institute) estimates that more than 100,000 EV fast charging ports will be needed to support the nearly 22 million EVs projected to be on U.S. roads in 2030.

As of 2020, electric power industry CO2 emissions are **40%** below 2005 levels.

There are more than **2 million** electric vehicles on U.S. roads.

50 EV car models are available today, 140 models are expected by 2024.

Only **2%** of new car sales are electric as of 2020.

ELECTRIC TRANSPORTATION

Electric transportation goes beyond cars. Trains, trams, buses, and bikes are also now electric. Worldwide sales have surpassed a million vehicles according to Energy Transition, with experts predicting new registrations of diesel vehicles will be gone by 2025.

In 2018 there were around 4 million battery and hybrid cars on the road. Most of these were in China and in the US. In Europe, Norway has the highest rates of electric vehicle ownership and by 2025 all vehicles sold will be electric.

Countries around the world are looking into prohibiting sales of non-electric vehicles by around 2030, while German cities are banning diesel vehicles within city limits.



NASA: ELECTRICITY TAKES FLIGHT

Ames Research Center has supported NASA's missions in aviation science and technology since the agency was founded. Green Aviation involves activities to improve aircraft fuel efficiency, develop the next generation of efficient air traffic control, and develop new technologies and systems engineering processes to reach the future of carbon-neutral air transportation across the globe.

NASA's X-57 "Maxwell" is the agency's first all-electric experimental aircraft, or X-plane, and is NASA's first crewed X-plane in two decades. NASA's X-57 project is an all-electric experimental aircraft designed to demonstrate multiple leading-edge technologies. The primary goal of the X-57 project is to share the aircraft's electric-propulsion-focused design and airworthiness process with regulators, which will advance certification approaches for distributed electric propulsion in emerging electric aircraft markets. The first flight of the X-57 is scheduled to take place in 2022.

Learn more about the X-57 electric airplane with this STEM Learning Module from NASA.





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SUSTAINABLE AGRICULTURE



Commercial agriculture has taken a toll on the environment including forest clearing, destruction of habitats, and carbon output contributing to greenhouse gas emissions. Pesticides, fertilizers and other toxic farm chemicals poison fresh water, marine ecosystems, air and soil and remaining in the environment for generations to come.

The goal of sustainable agriculture is to meet the worlds need for food and agricultural products without compromising the ability of future generations to meet the same needs. In addition to preserving the earth's natural resources, sustainable agriculture focuses on practices that benefit the environment such as maintaining soil quality, reducing erosion, and preserving water and natural eco-systems.

Sustainable farmers are guided by three principals: a healthy environment, economic profitability, and social and economic equity. Every person involved in the food system from growers, food processors, distributors, retailers and ultimately consumers, play a role in ensuring a sustainable agricultural system.

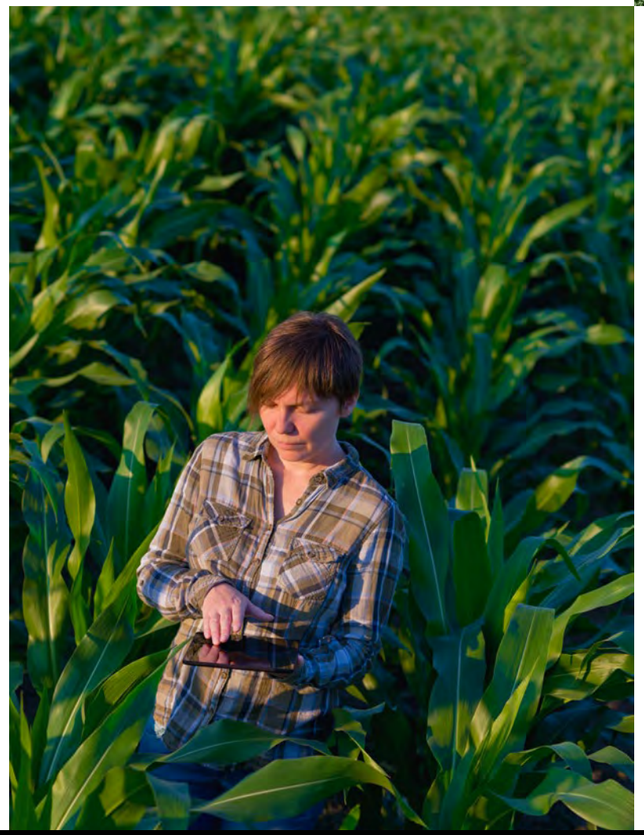
Growers promote soil health, minimize water use, and lower pollution levels on the farm. Consumers and retailers concerned with sustainability can look for "values-based" foods that are grown using methods promoting farmworker wellbeing, that are environmentally friendly, or that strengthen the local economy.

SUSTAINABLE AND ECO-FRIENDLY FARMING CONCEPTS

- Permaculture
- Aquaponics and Hydroponics
- Renewable Energy
- Crop Rotation
- Agroforestry
- Soil Science









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PEPSICO

BUILDING SUSTAINABLE FOOD SYSTEMS



Q How does Environmental Sustainability connect your company to the world?

A Guiding PepsiCo is our vision to Be the Global Leader in Beverages and Convenient Foods by Winning with PepsiCo Positive (pep+). pep+ is our strategic end-to-end transformation that puts sustainability at the center of how we will create value and growth by operating within planetary boundaries and inspiring positive change for the planet and people.

We believe that there is an opportunity to change how the world produces, distributes, consumes foods and beverages and disposes of packaging. We aim to use our scale, reach and expertise to help build a more sustainable food system, one that can meet human needs for nutrition and enjoyment and continue to drive economic and social development without exceeding the natural boundaries of the planet.

Q How has Environmental Sustainability changed the way you do business?

A At PepsiCo, sustainability has always been at the center of how we operate. That is why we are working to transform the way we create shared value. We recognize that creating a sustainable food system means tackling the environmental impacts of our operations and value chain head-on, working to make a positive difference at local and systemic levels, within and beyond our own value chain.

Accordingly, our sustainability strategy targets every stage of our complex value chain to use resources more efficiently, reduce GHG emissions, replenish water, improve our products and recapture packaging materials. For example, we've announced several new innovations, investments and partnerships to progress against our ambition to be Net Water Positive by 2030, aiming to replenish more water than our company uses. Our Global Research & Development team has successfully proven a groundbreaking method for condensing and treating the steam evaporated from its fryers to recover more than 50% of the water used in potato chip manufacturing lines. We have fully implemented this technology at our facility in Kolkata, India, where the proof-of-concept showed the approach could save ~60 million liters of water a year. Over the next seven years, the technology is expected to be adopted at nearly 30 potato chip manufacturing plants in high-water-risk areas.

Q What efforts or initiatives has your company implemented that relate to Environmental Sustainability?

A Our sustainability efforts span across our entire value chain. The following are a few examples of how we're doing business in a way that is more sustainable and inclusive:

- Since announcing our Net Water Positive ambition in August 2021, more than a dozen new programs have been created to advance our company's water efficiency, replenishment, and safe water access efforts. For example, our North America businesses are partnering with the non-profit Trout Unlimited to reestablish connectivity between two segments of the Colorado River that had been blocked by the Windy Gap Reservoir near Denver, Colorado. By constructing a mile-long channel to bypass the Windy Gap Reservoir, the initiative is expected to restore perennial flows throughout the river, create 18 acres of new wetlands, restore 50 acres of riverside habitat, and replenish approximately 380 million gallons of water per year.

- Additionally, building on a decade-long, successful partnership with the Inter-American Development Bank (IDB)'s Aqua Fund, the PepsiCo Foundation is committing an additional $500,000 to improve water access and sanitation services across the Latin America region, bringing the Foundation's total investment to over $10 million. In Nigeria, the Foundation is granting $1 million to WaterAid to support the construction of water supply and sanitation facilities and the development of programs to promote good hygiene practices.

- In our Europe sector, we have been working to reduce unnecessary packaging across our individual bags and multipacks as part of our commitment to a 50% reduction in virgin plastic per serving by 2030. Progress is being made towards this goal, including in markets such as the UK where on some parts of the range, we have reduced our multipack outer by up to 30% using innovative technology in our manufacturing facilities.

- Reinforcing PepsiCo's desire to create a world where packaging never becomes waste and to increase recycling rates in the United States, PepsiCo Beverages North America made a $35 million investment with Closed Loop Partners that will create the "Closed Loop Local Recycling Fund," an innovative circular economy initiative to advance new small-scale, modular recycling systems in communities across the U.S. The fund aims to increase recycling in areas with no or limited access to recycling, reducing waste and unlocking a new supply of recycled plastic (rPET), among other valuable materials, to support our goal to cut virgin plastic from non-renewable sources across our food and beverage portfolios by 50% by 2030.



Q What jobs or careers does your company offer in Environmental Sustainability?

A Working at PepsiCo is more than a job, it's an opportunity to build a meaningful career. With a presence in more than 200 countries and territories, go just about anywhere, and you'll find an opportunity to make an impact. We recommend visiting our careers site at www.pepsicojobs.com and search "sustainability" and you'll find opportunities from New York to São Paulo.

A background in STEM can open many doors for a career at PepsiCo. There are associates with degrees in Food Science, Chemistry, Biology, Polymer Science, Nutrition, Data Analytics, Agriculture as well as multiple Engineering disciplines: Mechanical, Chemical, Environmental, Automation, Processing, and Packaging.

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PEPSICO PROFESSIONAL SPOTLIGHT



Yolanda Malone

Vice President of Global Foods Packaging in PepsiCo's Global Research & Development organization.

I lead a global team of engineers and scientists across 13 countries who provide technical packaging engineering support on specific projects and brands, including sustainability initiatives, new product launches, equipment development, and overall packaging troubleshooting. This diverse team consists of several engineering disciplines, including Packaging Engineers, Mechanical Engineers, Polymer Chemist, Process Engineers, and Chemical Engineers. They work collaboratively to solve complex challenges and leverage, in most cases, scientific methods to devise solutions for those challenges.

Packaging plays an essential role in safely delivering our products to customers and consumers. PepsiCo designs our packaging materials to balance several critical criteria, including compliance with food safety regulations, maintaining freshness and quality of the product, environmental sustainability, affordability, and consumer preferences.

For example, one of our projects is focused on compostable snack packaging. This is a very complex structure of several layers of polymer-based materials of which most is not sustainable. Our team analyzes the chemistries of those materials, conducts research for new and/or more environmentally friendly alternatives that uses less plastic (or no fossil-based plastic), less energy and produces less waste. Given packaging plays a key role in our overall sustainability agenda, it requires an ecosystem of inputs. We have strategic oversight by PepsiCo's executive leadership and input from a multi-functional group of experts, including my team and others in Research & Development, Supply Chain, and the Office of Sustainability, to name a few. Everyone has a role to play.

Q What career path did you take to get to your current role? (Prior education, internships, programs, etc.)

A Right from the beginning, I was destined to be in Engineering. I earned a Packaging Engineering degree from Michigan State University, but that's not where I started in my field of study. I always loved science, robots, and computers in high school which led me to believe I wanted to be a computer programmer. After the first year of debugging programs via the punch-card system, I questioned whether I made the right choice. So, I started inquiring about other engineering majors and disciplines. I took an introductory course on Packaging Engineering, and I was hooked.



It was an easy choice; and I was encouraged by the obvious fact that everything we buy comes in a package. From our pharmaceuticals, foods, detergents, and cosmetics, these products all need a package to be on the store shelf -- there was clearly some assurance of job security.

I then transferred my science and engineering course credits in computer science towards earning a packaging degree. Michigan State offered Cooperative Education Programs or Co-ops, an immersive educational program which allows engineering students to alternate periods of academic study with full-time periods of paid work experience related to their academic and professional goals. Even though it extended graduation, students sometimes did more than one of these co-ops because they were able to gain valuable work experience, get compensated well, and position themselves for jobs upon graduation.

My co-op was in the pharmaceutical industry which led to multiple job offers upon graduation with several big pharmaceutical companies. After 5 years, I transitioned into the food industry working on snack brands which was invigorating and satisfied my desire for a different pace. It's important to note, for packaging engineers, the roles at various companies are very similar. We develop packaging structures to house and protect products. The differences are the products you work with.



From working cross-functionally with partners in Marketing, Purchasing, Engineering, Supply Chain, Finance, Consumer Insights, and R&D associates to being able to work on beloved brands such as Pepsi, Mountain Dew, Lipton, Starbucks, Quaker and deliver great packaging for these products -- I simply love what I do! Leading Food Packaging, I assist my teams around the world to deliver even more sustainable packaging solutions for consumers.

My mom was not thrilled when I made the decision to leave computer science to make boxes. Fast forward, I am a Vice President of Foods Packaging with teams around the world. Needless to say, Mom is happy and very proud.

Q What advice would you give to someone interested in pursuing your career?

A It's okay if you don't know exactly what science or engineering degree you want to pursue at first, but make sure to keep the foundational basics in your curriculum. As previously mentioned, many STEM degrees offer various opportunities to enable you to make a positive impact in the sustainability sphere.

Secondly, it's okay to switch, but try to do that early enough, so you aren't wasting time pursuing something you may not truly love or have a passion for. There are instances where students do multiple internships or co-ops to decide where they fit or what is most fulfilling for them. For me, I began to layer on my experiences to continue to learn more and deepen my expertise. I started in pharmaceuticals, then switched to snack foods. I then expanded to all types of foods with various processing conditions to preserve the products. I discovered that I was deepening my technical skills in food, but lacked the experience with beverages, so I sought the opportunity to start building that skillset.

Hello PepsiCo! At PepsiCo, I had the opportunity to lead Food and Beverage packaging teams all in one company. That's a WIN-WIN! Sustainability, which was always part of my career in some way, now is a major focus and requires a background in STEM to understand the challenge and provide long-term solutions to those challenges.

In short, a STEM degree opens many doors as there is so much foundational learning. A job that may not seem like a fit initially, could blossom into a fulfilling career. Don't limit yourself, as there are opportunities abound. You have to stay focused, apply your learnings, and discover where this degree can take you to make a positive difference.

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COMPANY SPOTLIGHT

ABBOTT



For Abbott, a sustainable future starts with health. Abbott is committed to safeguarding a healthy environment by reducing the environmental impacts of their business across the value chain. This commitment shapes the way they source, design, manufacture and distribute products, and it forms the basis for their environmental management systems and governance. We asked Abbott to tell us more about how environmental responsibility has impacted the way they do business.

Q How has Environmental Sustainability changed the way you do business?

A As Abbott has grown, so has the breadth and depth of its sustainability work, which now reaches all global operations, as well as product development and supply chain practices. Since the early 2000s, Abbott has published a global sustainability report and has outlined, measured and monitored environmental performance goals. The company is working across operations and with key suppliers to sustainably manage water use and address climate change by reducing carbon emissions and expanding renewable energy. Abbott also aims to reduce the environmental impact of product packaging and minimize waste in operations through reuse and recycling programs across the company.

Q What efforts or initiatives has your company implemented that relate to Environmental Sustainability?

A Abbott's 2030 Sustainability Plan establishes targeted goals for reducing carbon emissions, sustainably managing water use and applying circular economy principles to reduce the environmental impact of product packaging and waste in operations. To support these goals, Abbott has updated its strategy, policies and targets to reflect a commitment to environmental protection both across its operations and through work with strategic stakeholders and suppliers. You can find the detailed goals at abbott.com/sustainability.

Q What jobs or careers does your company offer in Environmental Sustainability?

A Abbott is taking targeted action to build the diverse, innovative workforce of tomorrow, including in environmental sustainability and other STEM areas. New ideas come from different places and points of view. To achieve our ambitions, the company is actively shaping the organization for the future by prioritizing diversity and inclusion, advancing STEM education and internships, and empowering teams with skills to meet the health needs of tomorrow.

Because sustainability is embedded across Abbott, opportunities for employees to interact with sustainability initiatives are present in many areas, including research and development, procurement, operations, and engineering.

For example, engineering professionals may design and execute a project that reduces water consumption at one global manufacturing facility and an operations professional may implement a project to shift a waste's fate from disposal to reuse.



PROFESSIONAL SPOTLIGHT

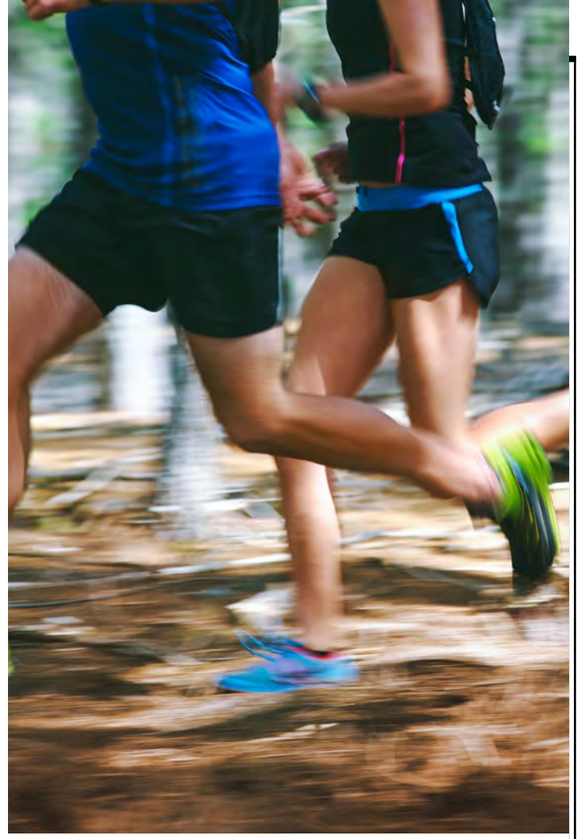
Nicole Roseberry

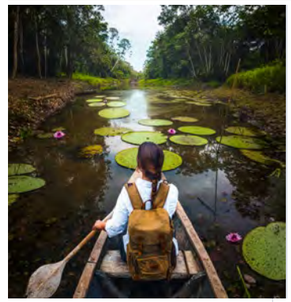
Programs Manager, Global Environmental, Health and Safety

Nicole Roseberry is an Environmental Programs Manager, Global Environmental, Health and Safety, at Abbott. Nicole's team is responsible for driving strategy to enhance environmental performance in operations worldwide and reporting on environmental indicators to external stakeholders.

What career path did you take to get to your current role? (Prior education, internships, programs, etc.)

Nicole has over 18 years of experience in environmental, health and safety and is a graduate of the University of Iowa with Bachelor of Science degree in Chemical Engineering. She is a Professional Engineer and a LEED-Accredited Professional. Nicole has worked with Abbott for over nine years and was a project engineer, providing environmental consulting services for companies in various manufacturing sectors, prior to joining Abbott. She also held internships and cooperative-education experiences while earning her undergraduate degree.







Q What role(s) do you see in the future for Environmental Sustainability?

A The need to safeguard our environment and protect our resources will continue to intensify as climate change impacts, such as severe weather and water scarcity, become more prevalent. We must continue to develop and deliver on initiatives that help protect the planet and preserve our ability to enjoy our future. To do this, we need new innovations, technologies and ways of thinking – a key for future generations.

Q What advice would you give to someone interested in pursuing your career?

A Remain honest, creative, and informed! The regulatory landscape for environmental disclosures continues to evolve rapidly all while new technologies aimed at reducing environmental impacts materialize on a regular basis. It will take strong and ambitious innovations to keep our global population resilient and protect our resources.

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MICRON HOW HIGH-TECH LEANS INTO SUSTAINABILITY









As a leader in innovative memory solutions, Micron is helping the world make sense of data by delivering technology that is transforming how the world uses information. Micron manufactures today's major memory and storage technologies including DRAM, NAND, and NOR technology.

From the company's beginning in Boise, Idaho, Micron has grown into an influential global presence committed to being the best memory company in the world. In 1999 they established the Micron Foundation and identified science, technology, engineering, and math (STEM) education as a priority for Idaho students. Today, the Micron Foundation's initiatives have become leading resources for educators and students in Idaho communities and beyond.

Microns commitment to sustainability is demonstrated in their sustainability goals to reduce greenhouse gas emissions, use 100% renewable energy by 2025, conserve water and minimize waster through reuse, recycling and recovery.

We asked **Marshall Chase**, *Director of Sustainability at Micron* how high-tech leans into environmental sustainability and here's what he had to say:

Q How does Environmental Sustainability connect your company to the world?

A Our company, and all companies, depend on natural resources and need to be good stewards of the environment. Semiconductor manufacturing requires a lot of clean water, so Micron works with our communities to ensure that local water resources are managed effectively.

Q How has Environmental Sustainability changed the way you do business?

A We strive to reduce our environmental impact through things like buying renewable energy, managing our water use, and making energy-efficient products, as well as the way we invest.

Q What jobs or careers does your company offer in Environmental Sustainability?

A There are a lot of ways that people can work on environmental sustainability at Micron, whether managing environmental compliance, addressing the environmental impact of our operations, identifying startups offering environmentally preferable technologies, or developing sustainable financial arrangements. A growing number of people have found ways to incorporate sustainability into roles that aren't formally sustainability jobs.

Q What career path did you take to get to your current role?

A Most recently, I was a sustainability consultant for ten years with Business for Social Responsibility (BSR), and led BSR's work with large manufacturing companies. Before that, I was a graduate fellow with the American Chamber of Commerce in Armenia, earned master's degrees in business and natural resources, while interning at Ford Motor Company and at Environmental Defense fund, ran waste and recycling programs for several commercial real estate companies, and was a Peace Corps Volunteer.

Q What advice would you give to someone interested in pursuing your career?

A Hike your own hike. Find ways to do what you are passionate about as part of (or in addition to) whatever job that you have.

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RESOURCES & CONTRIBUTORS

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PEPSICO
Trish Kenlon
Founder

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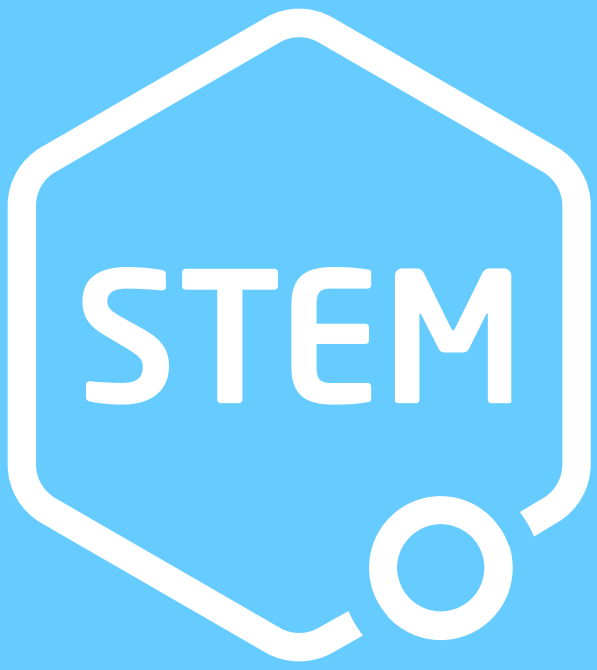
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