CELEBRATING A DECADE OF SOLUTIONS

Stanford
WOODS
INSTITUTE *for the*
ENVIRONMENT

Crossing Boundaries, Seeking Breakthroughs

Given its origins, it's no wonder Stanford was among the first American universities to create a major interdisciplinary environmental institute.

The visionaries who dreamed that a sprawling farm could become a world-leading university drafted a founding grant that emphasized the development of practical knowledge to promote public good. They designed the university's main quad to encourage interaction among departments, and they appointed a natural scientist with broad interests as the first president. In the years since, Stanford has become an internationally recognized icon of innovation.

Photo: Tim Griffith

The Jerry Yang and Akiko Yamazaki Environment and Energy Building received a top LEED sustainability rating in 2013.

That drive to cross boundaries and collaborate in pursuit of breakthrough solutions is the institutional DNA at the core of the Stanford Woods Institute for the Environment. The Institute was envisioned as Stanford's hub of environmental research—a collective of forward-thinking natural and social scientists, engineers and others seeking to protect and nurture our planet to meet the vital needs of people today and of generations to come.

"We knew the complexity of today's global sustainability challenges requires that experts from a variety of fields work together to solve problems with an integrated, blended approach," recalled Engineering Professor Jeffrey Koseff. He and Law Professor Buzz Thompson were tapped in 2004 to lead Stanford's fledgling environmental institute as Perry L. McCarty co-directors and senior fellows.

"Our faculty have always wanted to improve the world, so they were naturally drawn to Woods to help them achieve that goal," added Thompson. "There is a recognition that together we are more than the sum of our parts. And by working together, we can discover new, novel solutions."

That spirit of interdisciplinary collaboration has spawned a range of bold advances during the Stanford Woods Institute's first decade. Woods researchers have engineered a low-cost technology to recover clean energy from wastewater, inspired the launch of a company that develops bioplastics, and developed sophisticated software tools to guide natural resource management, among other breakthroughs. Woods has catalyzed millions of dollars in seed funding for Environmental Venture Projects (see page A6), and incubated new centers

PRACTICAL SOLUTIONS • 10 years • PEOPLE & PLANET

2004

Founded: Stanford launches interdisciplinary Institute for the Environment.

Awarded: First Environmental Venture Projects (EVP) seed grants.

Created: First Nations' Futures Institute for young indigenous leaders.

2005

Launched: An ongoing series of Uncommon Dialogues between leaders and researchers.

2006

Recognized: Environmental Institute named for Ward W. and Priscilla Woods.

and programs advancing research on climate change, ecosystem services and conservation, food security, freshwater, oceans, public health and sustainable development.

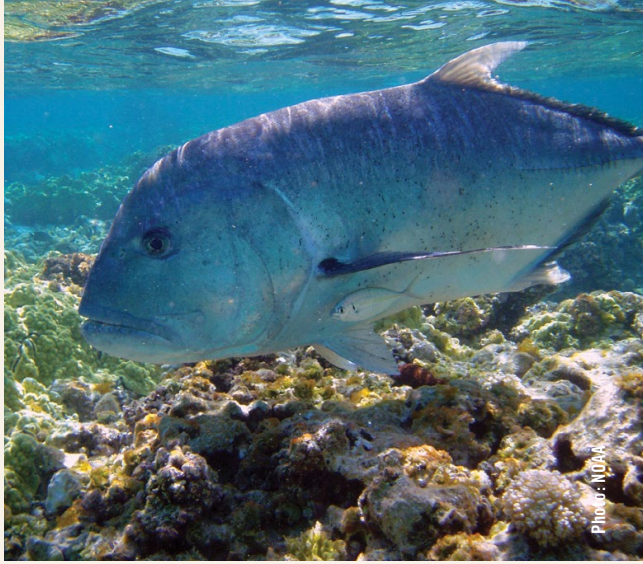
Visionary supporters such as Stanford Trustees Ward W. Woods, ’64; Pete Higgins, ’80, MBA ’83; Bill Landreth, ’69; Joan Lane; Mel Lane, ’45, CRT ’78; Susan Orr, ’68, MBA ’70, and Vicky Sant, ’61 helped the Institute grow quickly. Many of these early donors also served as strategic advisers and would later form the Institute’s advisory council. In 2006, the Institute was formally renamed for Ward Woods and his wife, Priscilla, whose significant contributions support innovative environmental programs and collaborative research.

A NEW PARADIGM

In blazing a path, the Stanford Woods Institute created new ways around age-old obstacles to collaboration. Those new approaches included specialized joint appointments that allowed research fellows appointed by Woods to also hold tenure-track positions in their schools. Promising junior faculty were given the freedom and flexibility to pursue interdisciplinary work. “That hadn’t been done in a methodical, institution-wide way,” Koseff said. “We helped write the rules.”

The new approach “broadened the community substantially,” Senior Fellow Roz Naylor said of the model’s appeal to world-class researchers seeking to do crosscutting work.

Woods also took an innovative approach to collaboration across sectors off campus, creating programs to convene global experts from Stanford and other leading academic institutions, government, NGOs, foundations and business. Through various forums, briefings and other events, Woods has helped leaders and decision-makers better understand and use science and innovation to address complex environmental issues, policies and management practices.



Woods-funded researchers have explored the resiliency of coral reef ecosystems to overfishing, ocean acidification and climate change.

Launched in 2004, the Uncommon Dialogues program has been one of the most effective such tools. These unique forums have allowed leaders from the public, private and nonprofit sectors to share perspectives with experts from Stanford and other academic institutions, while informing each other’s work, guiding leaders and laying the foundation for new publications and research initiatives.

2007

Innovated: A solar water pump for irrigation and drinking water in West Africa.

2008

Inspired: Uncommon Dialogue about ecosystem services leads to new federal office.

Convened: CA groundwater managers join forces following Uncommon Dialogue.

Advised: Research guides investment in agricultural adaptation to climate change.

2009

Invented: InVEST, a software tool to map and quantify ecological values.

Pioneered: Low-cost technology to recover energy from nitrogen in wastewater.

Natural Capital Project assessed Colombia watersheds for investment with the new Resource Investment Optimization System (RIOS) software.

Crossing Boundaries, Seeking Breakthroughs

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"Woods has always been unique in that we don't just wait for research to be completed, then disseminate it," said Woods Executive Director Debbie Drake Dunne, a veteran of state government and environmental policymaking when she joined Woods in 2005. "We've created new pathways for researchers to engage with diverse stakeholders, link knowledge to action and advance environmental decisions."

The Woods approach has served as a model. Other Stanford research institutes such as the Precourt Institute for Energy, as well as a dozen universities around the United States, have come to Woods for guidance on making joint faculty appointments and developing leadership programs. Organizations such as the Environmental Defense Fund and the First Nations' Futures Institute have approached Woods for expertise in establishing and running forums and education programs.

DEVELOPING LEADERS

Since its inception, Woods has been committed to preparing students and early career researchers to serve as leaders in their fields through a variety of leadership and mentoring programs focused on building skills, knowledge and networks. Through grants and stipends, Woods is supporting young researchers with promising new ideas for tackling environmental challenges.

"You're not only solving problems, but you're doing it in a way that creates the next generation of environmental leaders," Buzz Thompson said.

Educational courses, seminars and workshops offered by Woods have inspired and prepared hundreds of current and emerging environmental leaders. The Leopold Leadership Program has provided more than 150 scholars from around the U.S. with the skills, approaches and theoretical frameworks for translating their knowledge into action to address the world's most pressing sustainability challenges.

The Mel Lane Student Grants Program has empowered dozens of Stanford students to realize their visions for environment and sustainability projects such as an initiative to deploy affordable, dry household toilets in the

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2009

Envisioned: Study maps plan for shifting entire world to clean energy.

2010

Recommended: EVP report describes a more sustainable meat production system.

Kick-started: Company forms to scale up EVP-derived process for making biodegradable plastics.

2011

Awarded: $18.5 million NSF grant for urban water research seeded by EVP project.

Influenced: $178 million water project in Mozambique restructured with Woods input.

Discovered: Affordable way to monitor aquifers in farm regions using existing satellites.

A History of Environmental Initiative

When John Hennessy became Stanford's new president in 2000, he announced a renewed focus on interdisciplinary research and plans to assess 21st century priorities for university investment. That year, the Office of the Provost's environmental committee produced a report calling for a "major initiative" to make Stanford "a national leader in providing solutions for environmental problems."

Out of this, the campus-wide Initiative on the Environment and Sustainability was created in 2003 as part of Hennessy's "priorities" plan. As the initiative's centerpiece, Hennessy created the Stanford Institute for the Environment in 2004.

"It was a perfect example of bottom-up and top-down initiatives coming together," recalled Pamela A. Matson, dean of the School of Earth Sciences, referring to faculty who had been organizing environmental forums on campus since the early '90s.

In 1995, Stanford's Office of the Provost had tapped those faculty members to evaluate the benefits of integrating environmental research on campus. The Provost's Committee for Environmental Science, Policy and Technology was initially chaired by former university President Donald Kennedy and included Marc Feldman, Lawrence Goulder, Jeff Koseff, Perry McCarty, Lynn Orr, Roz Naylor, Joan Roughgarden, Steve Schneider, Buzz Thompson and Peter Vitousek. In subsequent years, Paul Ehrlich, Matson, Hal Mooney, Rob Dunbar and Wally Falcon joined the group, and Vitousek took over the leadership role. Most of these professors would become the core faculty of the Stanford Woods Institute for the Environment.

"It was about faculty coming together and making things work," added Mooney.

For an interactive, expanded version of this timeline, visit: **woods.stanford.edu/about/Decade-of-Solutions**

2012

Linked: Ocean acidification and economics in WA, leading to new state research center.

Linked: Study shows cutting time families must walk to get water can save young lives.

Launched: Rising Environmental Leadership Program, including D.C. Boot Camp.

2013

Briefed: National Press Club event informs D.C. stakeholders on climate attitudes.

Launched: RIOS, a conservation tool to assess watershed values in Latin America.

Published: First interactive map showing U.S. coastline protected by natural habitats.

2014

Engineered: New center for wastewater recovery research breaks ground on campus.

Environmental Venture Projects | Kick-Starting Solutions

Progress often requires risk.

Through its Environmental Venture Projects (EVP) program, the Stanford Woods Institute has nurtured daring ideas that move the world closer to solving challenges affecting our food, freshwater, air, climate and oceans.

Launched in 2004, this flagship program has awarded more than $9.5 million in seed grants to interdisciplinary research teams from all of Stanford's schools and departments, advancing their efforts to sustain life-support systems essential to a rapidly growing human population. These projects have led to approximately $40 million in additional funding, with 22 of 37 funded projects receiving follow-on funding—a nearly 60 percent success rate.

"It is very tough to get funding for piloting interdisciplinary work at this scale. EVPs fill an important niche," said grant recipient Jen Burney, a fellow at the Center on Food Security and the Environment. "It puts Stanford at the cutting edge of interdisciplinary environmental work by seeding innovative projects and training the next generation of scholars."

"It's a way to expand your horizons and overcome barriers to change," said Senior Fellow Richard Luthy. "If you want to make change in your field, it can't be business as usual. You can't do research as you've always done it. The EVP allowed me to go off in a new direction."

EVP SOLUTIONS SNAPSHOTS

- A 2004 EVP focused on developing biodegradable building materials led to the creation of a company that is working to make economically competitive, nontoxic bioplastics that naturally break down into a gas, which can then be reused to make more bioplastic.
- A 2007 EVP in West Africa generated data that could help bring solar-powered drip-irrigation systems to arid regions with endemic food shortages. National Geographic named the project to its list of "Five Most Hopeful Energy Stories of 2012," heralding it as a "solution in the developing world."
- A 2008 EVP helped lead to the establishment of an $18.5 million National Science Foundation research center that examines ways to improve the delivery of water to cities and suburbs.
- As part of a 2009 EVP, researchers began developing a low-cost technology to recover energy from nitrogen in wastewater. The project won a $100,000 U.S. Department of Energy award in 2012, and a member of the team was named to *Forbes* magazine's "30 Under 30" list of rising energy-sector stars.

Amy Pickering, a researcher with the Water, Health & Development program, trained colleagues for a public health study in Tanzania.

Photo: WHD Program/Stanford

Professors Brian Cantwell and Craig Criddle and graduate students have developed technology for recovering energy from wastewater.

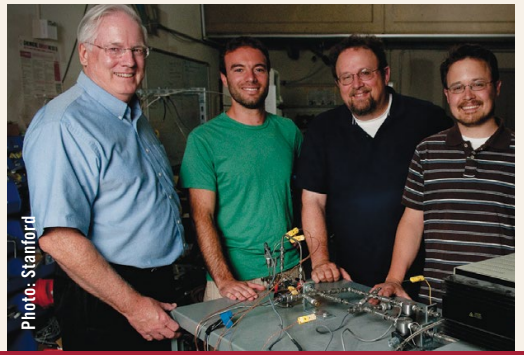

Photo: Stanford

Photo on right: Stanford researchers Tom Oliver and Jason Ladner check coral maps and prepare to collect samples for EVP research in Vatia Bay, American Samoa.

LOOKING AHEAD TO EVP 2.0

The next generation of Environmental Venture Projects is focused on scaling up solutions to foster their implementation. The 2014 crop of EVP proposals outlines ways projects could address important environmental challenges through the private market, government decision-making or individual behavior change. Woods staff members are working with EVP teams to facilitate engagement with actors who might adopt their findings and innovations. Through these and other joint partnerships, Woods is working to translate EVP research findings into practical applications.

Photo: Seabird McKeon

A Destination for Problem Solvers

A culture of collaboration across disciplines and a focus on solutions has attracted new faculty to campus via the Stanford Woods Institute since its inception as Stanford's hub for environmental research.

"Most institutions will say they want to do interdisciplinary work," said Senior Fellow Stephen Luby, a 2013 Woods faculty recruit. "The difference with Stanford and Woods is that desire is reinforced by a culture and expectation that we'll be working together." Luby, an epidemiologist who primarily studies developing world health issues, was drawn to the Stanford Woods Institute's focus on problem solving. "It's not just about generating research. But it seriously addresses the issues of non-sustainability and globally says, 'What can we do to make a difference?'"

Senior Fellow Jenna Davis, Woods' first faculty recruit, came to Stanford from MIT in 2004. "It was this notion that the most important problems are not disciplinary and they're not simple," said Davis, an associate professor of civil and environmental engineering who studies the intersection of health, economic development and environmental protection. "It's going to take new ways of organizing ourselves to respond. In everything Woods touched, you saw that."

Davis and other recruits who followed were eager to be part of a new model for research, joining experts from across Stanford's seven schools to create new partnerships and a rich exchange of ideas.

"The diversity of fellows is just fantastic," said Senior Fellow Giulio De Leo, an ecologist with engineering and economics expertise. "I've had the opportunity to work with colleagues I would not have met otherwise."

"It is gratifying to be in an interdisciplinary Institute that is a pioneer of the likely future organization of academia," added Senior Fellow Eric Lambin, a professor of earth system science

The emphasis on transformative, yet practical, solutions is another draw. Center Fellow Nicole Ardoin was attracted to Woods in part because it offered a home for her work on issues connecting people's sense of place and environment-related behaviors. "It's research with an eye toward the real world," Ardoin said.

FACULTY RECRUITS 2004-2014

1. Nicole Ardoin
2. Larry Crowder
3. Lisa Curran
4. Jenna Davis
5. Giulio DeLeo
6. Noah Diffenbaugh
7. Rob Jackson
8. Eric Lambin
9. David Lobell
10. Stephen Luby

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developing world that was named “Best Overall Solution” in a sustainability technology contest judged by representatives from NASA, Silicon Valley companies and Bay Area universities, among other institutions.

The Rising Environmental Leaders Program (RELP), which includes an intensive “D.C. Boot Camp” in the nation’s capital, shows students and postdoctoral scholars how they can effectively engage with the people and processes that drive policy and decision making.

“I feel like I have a map now in my head of the different avenues you can take to effect change,” said RELP participant Angelina Sanderson Bellamy, a postdoctoral scholar in environmental earth system science.

LOOKING AHEAD

In 2011, the Stanford Woods Institute launched a major planning process to guide its next phase of development, soliciting input from a broad range of interested parties including faculty, staff and external stakeholders. Based on this process, Woods crafted a five-year strategic plan to guide next steps toward a vision of a world in which societies meet people’s needs for water, food, health, energy and other vital services while protecting and nurturing the earth. Creating pathways to move research into action is a top priority. Transformative solutions are emerging. Now the Woods community is working to advance their implementation at the scale needed to sustain people and planet.

“We haven’t slowed down,” Senior Fellow Rob Dunbar said. “Just trying to help the world get through the next few decades to a century is of utmost importance.”

Lady Newnes Bay cliffs, Antarctica. Photo: Rob Dunbar

Q&A: John Hennessy | Meeting the Challenges of Sustainability

Since John Hennessy became Stanford's president in 2000, focus on the environment has become a priority. The Stanford Woods Institute for the Environment was established to advance solutions to global environmental problems. President Hennessy reflects below on 10 years of progress toward meeting the challenges of sustainability.

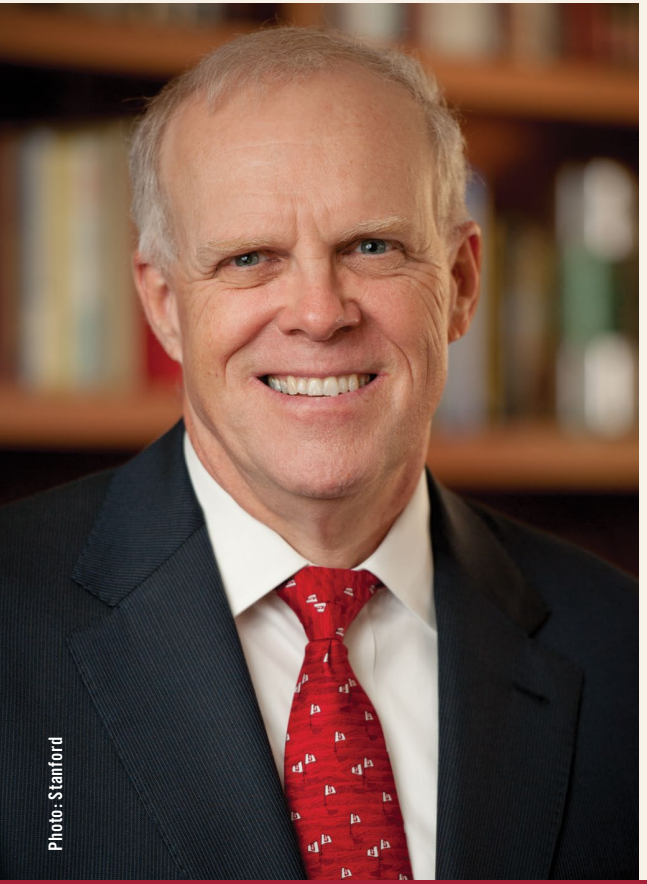


Photo: Stanford

What role do universities play in solving environmental problems? Has it evolved?

The basic model for the research and teaching university is a little over 200 years old, and its mission is twofold: to educate young people and to create new knowledge.

Increasingly, research and teaching are driven by the world's challenges. As the research mission evolved, the university has become a major source for solutions to the most challenging problems. New generations of talented young people take advances in knowledge and technology into the world and put them to work for the benefit of society.

In addressing environmental issues, not only do we bring expertise in technology and analysis, but we also give broad consideration to the political, cultural and ethical issues of potential solutions. Such a comprehensive approach is desperately needed.

What impact do you think the Initiative on the Environment and Sustainability and the Stanford Woods Institute have had throughout campus?

Stanford has a long history of leadership in environmental science and in putting its knowledge to work in various ways for the benefit of the greater community. With the Initiative on the Environment and Sustainability—and the Woods Institute—we have also put that knowledge to work close to home.

State-of-the-art facilities were created to support the latest research and improve our sustainability. We learned a great deal about sustainable design in building the Jerry Yang and Akiko Yamazaki Environment and Energy Building, informally known as Y2E2 and home of the Stanford Woods Institute. As a result, we developed new "Guidelines for Sustainable Buildings" at Stanford.

New buildings, such as the Knight Management Center—home of the Stanford Graduate School of Business—and existing buildings undergoing significant renovation were made more energy efficient. Last year, the Knight Center was awarded a LEED Platinum rating for environmental sustainability by the U.S. Green Building Council. Throughout campus, our research helps us reduce energy consumption and greenhouse gas emissions.

Why is an interdisciplinary approach integral to meeting today's environmental challenges?

The scope and complexity of today's environmental challenges—from water resource management to climate change to sustainable energy production to biodiversity and conservation efforts—are enormous. Much more is possible when scholars from different disciplines work together to address problems. These big challenges require the expertise and knowledge of the best minds in the world working collaboratively.

For example, the oceans provide essential support to humans as sources of sustenance and livelihood and are home to valuable ecosystems. Despite that, little work linked marine research and policy before the Center for Ocean Solutions (COS) was launched in 2008. A very effective collaboration among the Stanford Woods Institute and Hopkins Marine Station, the Monterey Bay Aquarium and the Monterey Bay Aquarium Research Institute, COS brings its expertise in policy, research, technology and education to bear on the challenges facing the oceans. Its researchers have developed practical solutions and changed the way agencies and policymakers think about the impact of research on problems.

Coral reefs are one of our planet's most endangered ecosystems, threatened by overfishing and warming ocean temperatures. Several projects supported by the Environmental Venture Projects program have looked at how we might be better stewards in the future.

Some years ago, an interdisciplinary team of biologists, anthropologists and ecologists worked with local residents to learn more about the impact of overfishing on two coral reef systems in the Pacific and to develop a sustainable approach for these and other reef fisheries. Information was shared through classes, town hall meetings and reports to government officials to increase awareness of ways to be good stewards.

These and many other collaborative efforts at the Stanford Woods Institute—crossing disciplines as well as institutional and national boundaries—bring new perspectives on problems and are likely to have a greater impact.

Have you been particularly inspired or encouraged by the work Stanford researchers are doing to advance solutions to the world's most pressing environmental challenges?

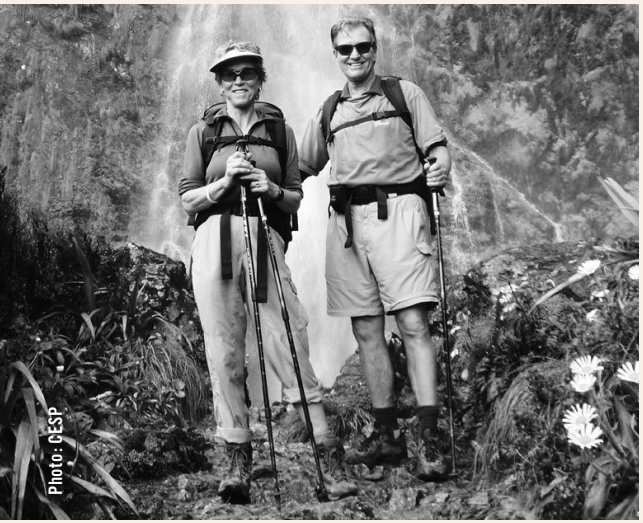
When Jane and Leland Stanford established this university, their goal was that the education it provides be both pioneering and practical. Part of the university's mission is to show what is possible, and the Stanford Woods Institute for the Environment has led the way, pioneering advances through its many centers and programs that have benefited communities around the world.

It also transfers knowledge to the greater community through a variety of programs. Emerging leaders get hands-on training in its First Nations' Futures Institute and its Rising Environmental Leadership Program. Current scholars are trained through its Leopold Leadership Program, which has developed a network of more than 150 environmental leaders working on a host of challenges.

Through these and other programs, the Stanford Woods Institute ensures the best environmental practices and knowledge are discovered and effectively communicated beyond the academy. I think this is deeply encouraging for the welfare of our planet.

Q&A: Ward W. Woods | Investing in Real World Solutions

In 2006, when the Stanford Institute for the Environment was renamed for Ward W. Woods, '64 and Priscilla B. Woods, it represented the culmination of Ward Woods' dedication and commitment to a world-changing idea.



Priscilla and Ward Woods.

A Stanford trustee from 1996 to 2006 and a former chair of the Stanford Management Company's Board of Directors, Ward Woods has been a devoted, longtime supporter of Stanford, its sustainability research and a range of environmental causes.

At the request of Stanford President John Hennessy, Ward Woods joined several other university trustees and friends, together with Professors Jeff Koseff and Buzz Thompson, in crafting a strategic plan for the Institute. Together, they laid the groundwork for how the interdisciplinary, solutions-focused model would function.

What motivated you to support this new environmental initiative at Stanford?

The combination of an interdisciplinary approach with a research program that would produce real-world solutions just seemed to resonate. I became more and more excited about the potential.

What makes Stanford especially well suited to tackling the challenge of solving the world's most pressing environmental challenges?

The idea of both interdisciplinary research and solutions-oriented research captivated the audience here at Stanford. Immediately, teams were put together and quite a few proposals were submitted for our Environmental Venture Projects.

Was there something different about the approach proposed for the Stanford Woods Institute that appealed to you?

There was an inclusion of ideas and an excitement about doing something that maybe was a bit out of the academic tradition in that it was to be solutions oriented and interdisciplinary.

When you look back over the progress Woods has made, what do you find most inspiring or encouraging?

It has been gratifying that there have been a number of individual solutions discovered. I am particularly proud of the Environmental Venture Projects program. Among other accomplishments, it has led to the Natural Capital Project, a joint venture that provides a much more definitive and scientifically credible means of understanding the value of nature to humankind. It has also inspired the development of a solar water pump for irrigation, a process for converting methane to bioplastic and a technology to draw energy out of wastewater.

What do you hope Woods will accomplish over the decade to come?

I believe that we have just begun, and that this Institute can continue to grow, continue to provide important solutions-oriented research and continue to inform policy with objective science.