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INSIGHTS

LETTERS

INGENUITY: NEXTGEN'S VISION

Nurturing connections to the environment

It seems increasingly clear that our future depends on people caring more about the environment, yet as technology develops, people seem only more disconnected from nature. We asked young scientists: **How can scientists in your field help people see the value of our natural environment?** Scientists from across the world, with expertise in a variety of fields, suggested ways that scientists can make nature more relevant and use research results to facilitate sustainable behaviors. Read a selection of the best responses here. —Jennifer Sills

Relate to health and safety

Ecologists can help people recognize the value of the services provided by natural ecosystems, such as the clean water and flood safety provided by healthy river valleys and the crop pollination provided by diverse insect communities. Scientists can explain how natural, undisturbed systems provide us with multiple services

vital to our physical, mental, and even financial well-being.

Barbara Pietrzak

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Clinical and medical researchers can educate patients and laypeople about the health hazards of pollution, toxins, and pesticides in water, soil, and air. If

people know the importance to their health and well-being of keeping their surroundings clean and conserving nature, they will appreciate and care for the natural environment.

Vandana Sharma

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Pharmaceutical scientists should educate patients and the general public about the natural origins of their commercial drug products. This will allow laypeople to connect the pharmaceuticals they consume to the natural environment, which in turn delivers the message that nature is vital to the sustainability of people.

Dhanuka Wasalathanthri

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The influence of environmental disturbances on the emergence of disease outbreaks is increasingly evident. Geneticists and those in related fields should disseminate the idea that environmental equilibrium is a public health issue.

Joel Henrique Ellwanger

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Inspire with stories and imagery

Stories can promote environmental stewardship by bridging the gap between scientific knowledge and public engagement. Researchers can conduct joint field trips with members of the public where they mutually share stories about human activities and the natural environment. The stories will help instill curiosity about the environment, while the field trip will promote scientific collaboration. The natural environment provides an excellent backdrop for storytelling through the diverse audio-visual and olfactory stimuli. Indigenous communities have many traditions involving storytelling while experiencing nature. The stories help the communities to value the natural environment and foster behaviors that promote conservation.

Edmond Sanganyado

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Humans harm nature unwittingly, so conservation science should encourage people to act sustainably even without thinking. This will not be achieved with data alone because automatic cognitive processes are not formed in the rational parts of our brains. People need to be inspired by conservation

science, not put off by constant messages of doom and gloom. We can do this by framing our hard-earned data in metaphors portraying nature as resilient and formidable, rather than fragile and controllable. Perhaps it's time that conservation scientists add poetry and art to our studies of plants and animals.

Falko Buschke

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Technology helps archaeologists document the complexity of change over intervals of centuries using time-lapsed animations and three-dimensional visual mapping.

It is now possible to align environmental perturbations, sea-level changes, droughts, and El Niños with man-made alterations to landforms, then on top of that overlay oral histories that narrate these changes in generational time. These composite images captivate our visual and auditory senses, and we should share this experience with the larger community. Connections created



TOMORROW'S EARTH

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Scientists can show the value of nature by explaining that healthy river valleys provide clean water and prevent flooding.

through social media provide the ideal forum for this—advancing a global outreach for science while inviting benefactors, citizen scientists, and young explorers to experience our changing world for themselves.

Felicia Rounds Beardsley

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By developing robust models to understand environmental trends and forecast how current unchecked practices will affect the natural environment, data scientists can present a well-reasoned, quantitative analysis and inspire people to be more engaged in sustainable and environment-friendly practices. Data scientists are uniquely poised to harness the power of patterns and tell compelling stories about nature. Statistical models might not be able to change people's reliance on technology, but they can certainly use that reliance to heighten our awareness about our natural environment.

Divyansh Agarwal

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We have unprecedented access to monumental volumes of data due to the increasing ubiquity of sensors for everything from air quality to ocean temperature. However, data alone are not enough to change public perception. More important than our ability to collect information is our ability to present it. The XY plots and bar graphs ubiquitous in the scientific literature are not visually compelling to most people. To more effectively communicate with the public, we must move past simple plots and work toward creating stunning visualizations that accurately convey data in context as part of compelling narratives.

Mark Martin Jensen

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Appeals and images that trigger emotional responses in people—a skinny polar bear or an oily tern—may have some impact, but to really get the public to consider the value of the natural world, it helps to engage their curiosity, too. Public engagement activities should not patronize but rather provide new information and the opportunity to think and problem-solve. Activities should leave the open questions in science open. When people are truly engaging with scientific problems, they can see both the value of

curiosity and the need for action to preserve and protect the natural environment.

Timothy L. Easun

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Support accountability

Corruption, inefficiency, and inadequate spending undermine efforts to steer humanity toward sustainability. Blockchain, a secure method of storing decentralized data, could be used to audit the environmental impact of firms or consumers in real time. The reliability, security, and auditability of data stored through blockchain can ensure that actors are held accountable, which could transform how organizations and individuals fund and execute environmental programs.

Han Lin

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Real-time feedback and interaction are powerful in promoting environmentally friendly behaviors. Through advanced sensing and measurement technologies in the Internet of Things, we can collect the various fine-grained behavioral data of people's daily life and activities and then measure their environmental impact with big data analytics. Wearable devices or mobile apps can in turn provide real-time feedback and personalized recommendations.

Kaile Zhou

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Identify systemic barriers

If scientists, in any field, are worried about the preservation of the environment, they would do well to point out the structural causes of environmental degradation. Roughly half of the human inhabitants of Earth produce no net carbon emissions. For the rest of the world's human population, a substantial part of the pollution output comes from areas in which people have only a marginal say, such as where they can afford to live and how their electricity is produced. These problems require systemic solutions, such as increased production of dense public housing (not detached single-family homes) situated along public transit lines and the elimination of fossil fuel-powered cars and power plants. The primary opposition to such endeavors does not come from average people who do not care about the environment, but rather from powerful corporations and

the handful of obscenely wealthy people who own them. This is what scientists should be making clear to the public.

E. Joseph Jordan

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Behavior analysts have been developing research on pro-environmental behaviors since the 1970s. Simple arrangements such as manipulating the location and number of trash bins and providing more information about recycled items in schools, offices, and universities have been shown to promote considerable increase in pro-environmental behaviors. Scientists could conduct more research on the topic and also focus on the dissemination of knowledge of effective strategies.

Fernanda Suemi Oda

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Behavior analysis indicates that small changes, such as making trash bins more accessible, can increase sustainable behavior.

The people of the world are presently facing a future where the prospects for their continued survival under any kind of decent conditions are extremely bleak. The reason we are in this position is not because individuals do not care enough about the value of the environment, but because our economic system is built from the ground up on rapidly growing consumption fueled by the extraction of finite resources, with absolutely no regard for the environmental consequences. Individuals have next to no power to escape such a system, much less create a new one that is compatible with our long-term survival. Environmental causes already have widespread support, but they require a level of global cooperation that has been very easy to undermine politically. The focus on appreciating nature diverts attention away from a

much-needed critique of our unsustainable global economic system.

Harry MacKay

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Engage educators and the media

As a former researcher and current high school teacher, I think the single most important thing that practicing scientists in any field can do is reach out to teachers and students at a local high school. Many teachers may be interested in having a scientist speak to their students, or in taking a field trip to an ecological, evolutionary, or plant biology laboratory, or in a nature walk guided by a local ecologist. But time is precious, and teachers may not know who is doing relevant work in their area. Scientists could even arrange a Skype call or offer to answer student questions about their scientific journeys. Scientists offer a unique perspective, and teachers would love to collaborate to share that perspective with their students.

Erin Coffey

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Biologists and environmental educators have incredible tools to facilitate authentic engagement. However, the science community, including funding agencies, does not provide adequate support for science communication and evidence-based outreach and engagement plans. People need the opportunity to experience nature as it works for them and fits into their lives. Nature-based apps, virtual reality experiences, and citizen science projects show how technology can serve as a supplement to a flexible and adaptable experience rather than a competing demand.

Rachel Yoho

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When I describe to people how I feel about the inherent beauty of nature, they listen. Once they share my enthusiasm, I take that opportunity to talk about the importance of biodiversity. To spread the message further, scientists who feel comfortable doing so should use every opportunity to make others aware of nature, including speaking to newspaper and radio journalists, giving a TED talk, giving talks to laypeople, and even creating nature-inspired music, as I have.

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