

Moore Center for Science

BREAKTHROUGHS

2021

CONSERVATION
INTERNATIONAL



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THANK YOU

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In 2021, the Moore Center:

Quantified nature's past and potential future contributions to climate stability.

Pinpointed the ecosystems humanity must conserve to avoid a climate catastrophe.

Measured and mapped human dependence on nature across the tropics.

Guided development of new UN standards for measuring the values of nature.

Dear Friends,

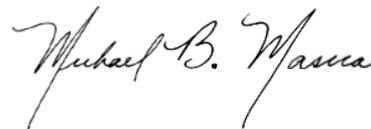
In 2021, the Betty and Gordon Moore Center for Science at Conservation International accelerated its pioneering research initiatives. Amidst profound impacts of the global pandemic on personal and professional lives, the Moore Center team displayed resilience, grace, and determination in its efforts to catalyze transformative change through science.

Breakthroughs 2021 illustrates the scale and scope of our accomplishments over the past year: global to local; high-tech to muddy boots; climate to wildlife to freshwater. The core of our portfolio remained true to the strategic goals we set for ourselves several years ago, but we have also evolved and responded to the disruptive impacts of the pandemic. Our successes — new protected areas, new technologies, new standards, new research — represent critical milestones in our efforts to deliver game-changing outcomes by 2025.

The coming year will take us in myriad directions: to the next rounds of international negotiations, to corporate boardrooms, to the halls of government, and to the homes of Indigenous peoples. As always, in each of these settings we will strive to listen, learn, and share the insights that will set our planet on a more sustainable trajectory.

Thank you for standing with us and accompanying us on this journey.

Sincerely,



Michael B. Mascia, Ph.D.
Senior Vice President
Moore Center for Science

OUR SCIENCE STRATEGY

Driven in large measure by the work of the Moore Center for Science, Conservation International's (CI's) institutional strategy — a.k.a. our Southern Cross — is dedicated to generating specific solutions to the most pressing conservation and development issues facing the planet.

This strategic focus has enabled the Moore Center to launch a systematic process to identify and answer three basic, yet deceptively complex, questions that are central to the quest for sustainability:

Priorities

WHERE IS THE NATURE THAT PEOPLE NEED?

Nature has a crucial role to play in global sustainability, but we require a better and more nuanced understanding of nature's part in sustainable development at global, national, and landscape/seascape scales. Put plainly, we need to understand where nature makes essential contributions to humanity in order to set priorities and guide investment.

Strategies

HOW CAN WE BEST CONSERVE NATURE FOR PEOPLE?

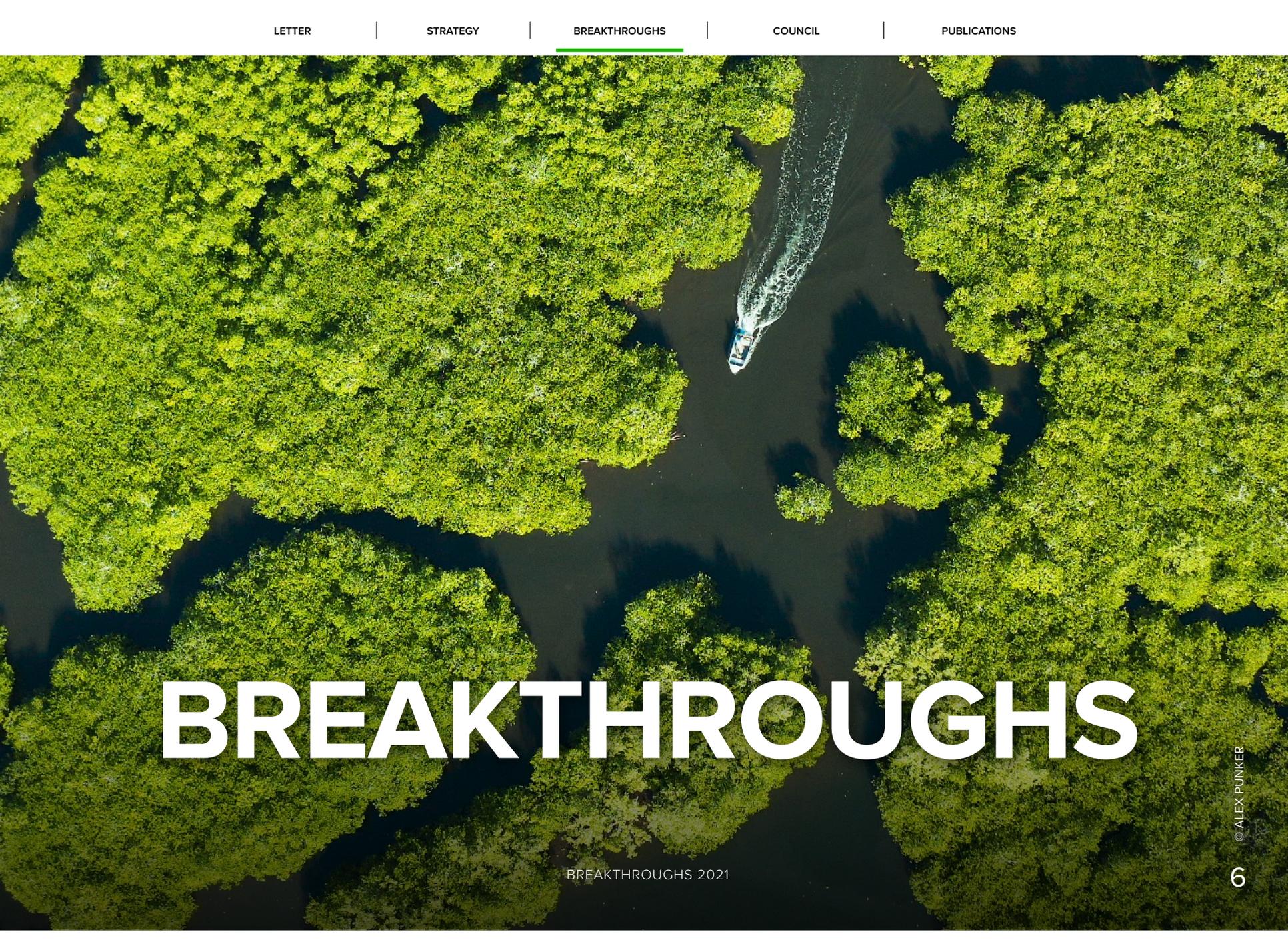
To maintain nature for people, society deploys conservation interventions in a range of contexts. Our research and decision-support tools empower governments, corporations, indigenous peoples, and other key decision makers to design tailored strategies that best conserve nature for people.

Impacts

WHAT ARE THE IMPACTS OF CONSERVING NATURE?

Evidence on the effectiveness of conservation policies and programs — what works and what does not — is essential to inform decisions and to demonstrate progress towards CI's mission, yet the impacts of most conservation interventions are poorly understood. Our research on the social and ecological impacts of conservation interventions catalyzes accountability, learning, and evidence-based decision making for smarter and more impactful actions.

Our answers to these questions are delivering transformative change: informing and influencing policy, changing conservation practices, and leveraging conservation investments globally.

An aerial photograph of a small boat navigating a narrow channel of a river that winds through a dense, lush green forest. The water is dark, and the surrounding trees are vibrant green, creating a high-contrast scene. The boat is positioned in the upper right quadrant of the image, leaving a white wake behind it.

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BREAKTHROUGHS 2021

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IRRECOVERABLE CARBON IN ECOSYSTEMS

Mapping the places we must protect to avert a climate catastrophe

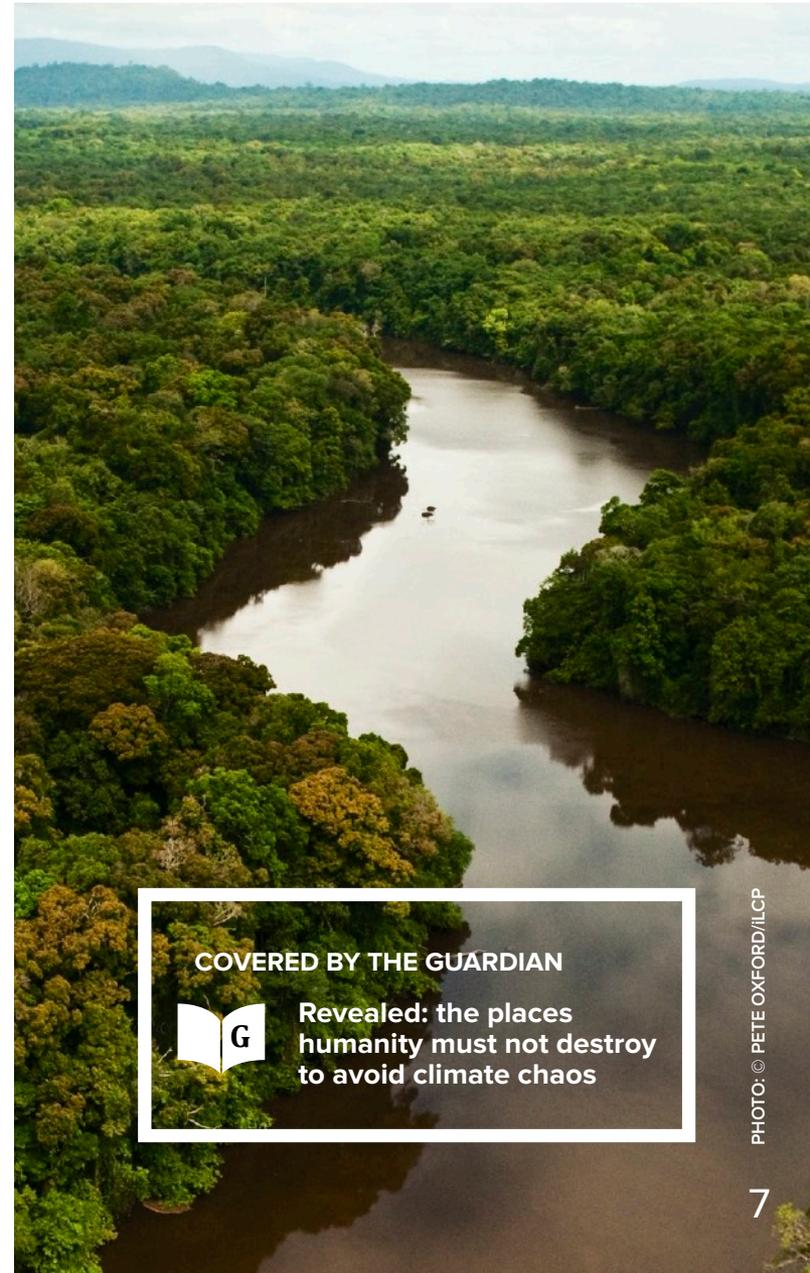
A Conservation International (CI)-led study pinpoints the ecosystems humanity cannot afford to lose in our efforts to stabilize Earth's warming climate. These places contain "irrecoverable carbon" — carbon that, if released by human activity, could not be recovered by 2050 — the year by which we need to reach net-zero emissions.

Published in *Nature Sustainability*, our global analysis and map of high-carbon areas builds on our 2020 landmark study introducing the concept of "irrecoverable carbon" in Earth's ecosystems. Our new study reveals that half of Earth's irrecoverable carbon is concentrated on just 3.3 percent of lands, including tropical forests and peatlands in the Amazon, Congo Basin, and Southeast Asia; the temperate forests of northwestern North America; and mangroves, seagrasses, and tidal wetlands globally.

Released following the UN Climate summit in Glasgow (COP26), this seminal research will help countries, corporations, and donors deliver on their climate commitments by focusing their efforts on the places that matter most. At least 48.4 percent of irrecoverable carbon is stored within protected areas or on Indigenous and community lands. By strategically protecting just 5.4 percent more land, humanity could protect three quarters of Earth's irrecoverable carbon. CI is aggressively translating these scientific insights into action, working on the ground and in international scientific, finance, and policy arenas to protect 4 million square kilometers (1.54 million square miles) of these climate critical ecosystems.

[READ THE PUBLICATION](#)

 [Mapping the irrecoverable carbon in Earth's ecosystems](#)



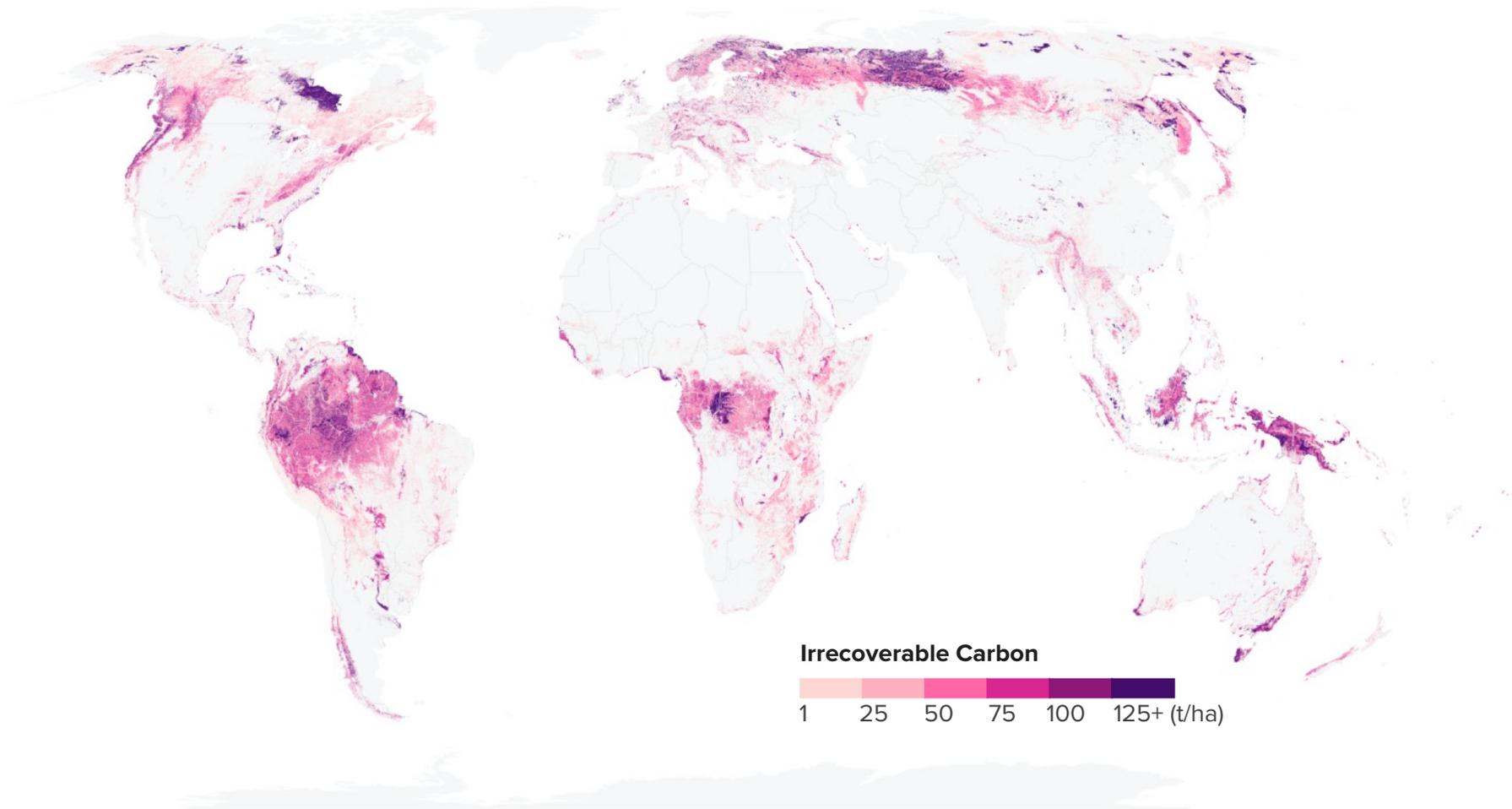
COVERED BY THE GUARDIAN



Revealed: the places
humanity must not destroy
to avoid climate chaos

IRRECOVERABLE CARBON

This map shows dense stores of ecosystem carbon which, if lost, could not be recovered by mid-century.



An interactive version of the map is available at irrecoverable.resilienceatlas.org

Source: Noon, et al. (2021) *Nature Sustainability*

BREAKTHROUGHS

NATURE-DEPENDENT PEOPLE

Mapping where nature is a matter of everyday survival

A new study by Conservation International (CI) scientists reveals that more than 2.7 billion people in tropical countries — 7 in every 10 — depend on nature for shelter, fuel, drinking water, or their livelihood. These findings underscore the interdependence of people and nature across the tropics, making clear that billions of people around the world need nature to survive.

Nature is an essential part of our daily lives, but some people depend more directly on nature than others for their basic needs. Until now, the number and location of these nature-dependent individuals and communities have been unknown, making it easy for policymakers to overlook them.

To determine how many people rely upon nature to meet their basic needs, CI scientists analyzed and mapped more than 5 million household interviews conducted across 85 tropical countries. Published in *Global Environmental Change*, our analysis found that more than 2.1 billion people depend on nature for fuel, 1.4 billion for shelter, 840 million for drinking water, and 1.5 billion for their livelihoods. Of the cumulative 2.7 billion people who rely on nature, two-thirds (1.8 billion) depend on nature to meet more than one of these basic needs for survival.

Nature-dependent people are often the most directly affected by environmental degradation, deforestation, and climate change. This study makes clear that strategies to protect, manage, and restore ecosystems — such as protection of old-growth forests, sustainable forest production, and mangrove restoration — can support the lives and livelihoods of those who need nature the most.

[READ THE PUBLICATION](#)

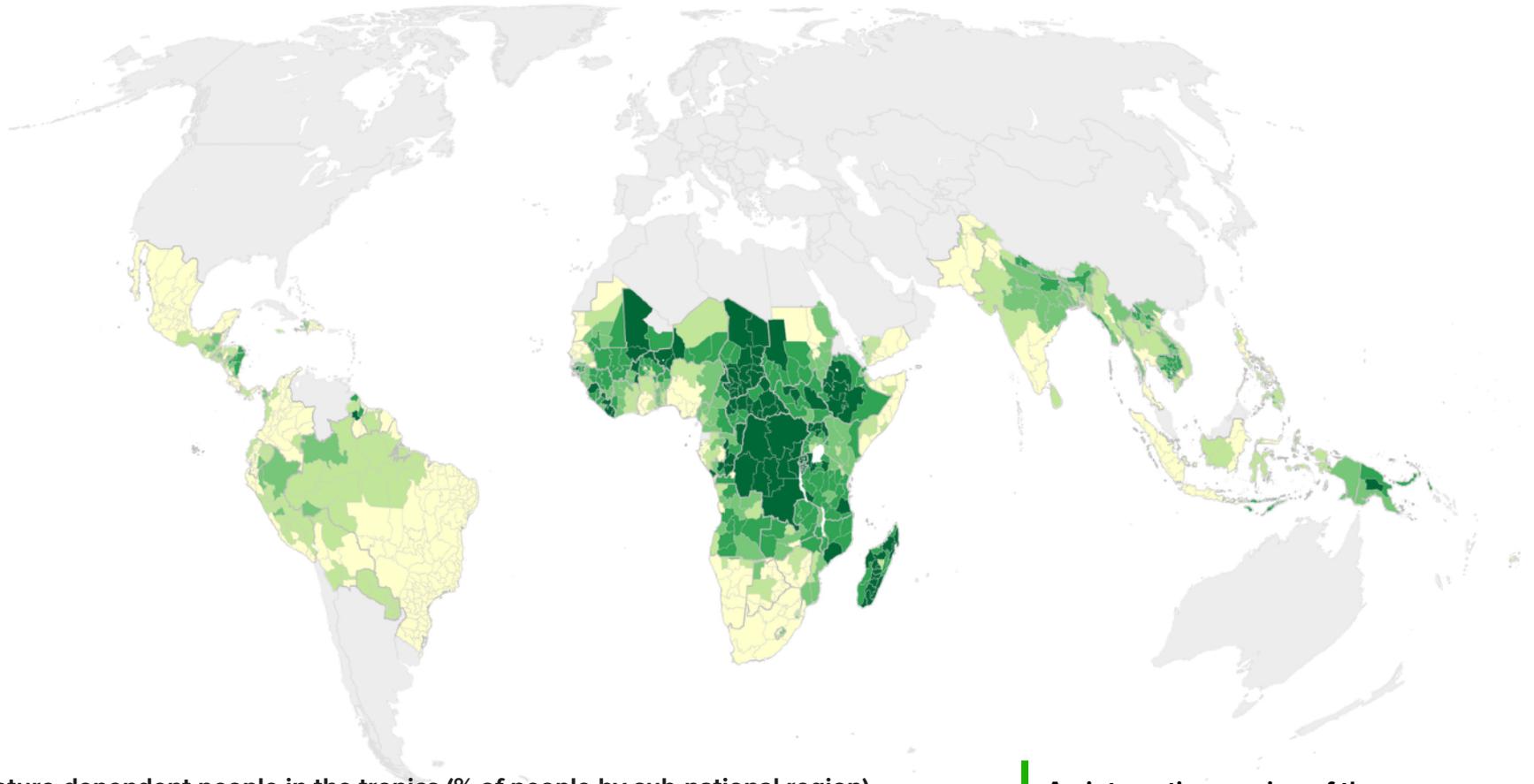


Nature-dependent people: Mapping human direct use of nature for basic needs across the tropics



NATURE-DEPENDENT PEOPLE

This map shows the proportion of people that highly depend on nature to fulfill their basic human needs at sub-national level across the tropics.



An interactive version of the map is available at ndp.resilienceatlas.org

Source: Fedele, et al. (2021) *Global Environmental Change*

We define nature-dependent people as those who use natural resources to meet at least one of the four basic human needs: drinking water, housing materials, energy for cooking, or livelihoods.

BREAKTHROUGHS

BIOSPHERE STEWARDSHIP

Quantifying nature's past and potential future contributions to climate stability

A landmark study by Conservation International (CI) scientists and collaborators underscores the vital role of the biosphere — Earth's terrestrial and marine ecosystems — in maintaining a livable climate. Without these ecosystems, humanity would have already surpassed 1.5 degrees Celsius (2.7 degrees Fahrenheit) global warming — the threshold beyond which the risk of catastrophic climate change rapidly increases.

Currently, about half of humanity's annual global carbon emissions are sequestered — absorbed and stored — by living ecosystems, such as oceans and forests. But nature's capacity to sequester emissions is becoming less stable — and is at risk of weakening significantly — as a result of both human pressures and climate change.

Published in the *Proceedings of the National Academy of Sciences*, our study provides a call-to-

action for humanity's stewardship of nature. After highlighting nature's role in stabilizing the climate, it lays out three key stewardship steps: halving global carbon dioxide emissions each decade to achieve carbon neutrality by 2050; transforming agriculture and forestry to absorb more greenhouse gases than they emit; and, conserving and restoring carbon-rich ecosystems such as old-growth forests.

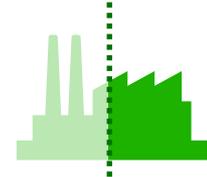
CI scientists and partners are now developing a roadmap to guide humanity — governments, corporations, Indigenous peoples, donors, and civil society — to protect, manage, and restore nature. This roadmap, known as the *Exponential Roadmap for Natural Climate Solutions*, will identify *who* must do *what* actions *where* and *when* to ensure nature fulfills its essential role in stabilizing Earth's climate.

READ THE PUBLICATION



We need biosphere stewardship that protects carbon sinks and builds resilience

BIOSPHERE STEWARDSHIP CALL-TO-ACTION



halve global carbon dioxide emissions each decade to achieve carbon neutrality by 2050



transform agriculture and forestry to absorb more greenhouse gases than they emit



conserve and restore carbon-rich ecosystems such as old-growth forests

BREAKTHROUGHS

ECOSYSTEM ACCOUNTING

Guiding a landmark framework for measuring the values of nature

As part of select group of international experts, Conservation International (CI) scientists played a key role in the development and launch of an official United Nations system for estimating the contributions of nature to economic prosperity.

This new global standard, known as the System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA EA), will enable government officials to consider the values of nature more fully within economic policymaking.

With the new standard in place, CI and our partners are now focused on accelerating implementation. For example, with support from CI and NASA, the Liberian government used insights from its national ecosystem account to update their international climate commitments and to monitor and report on their climate goals. Through high-level policy events and strategic partnerships, such as the World Conservation Congress (WCC) and the Group on Earth Observations (GEO), we are building the political momentum and the enhanced access to technology that will spur widespread adoption of ecosystem accounts by national governments.

 [The full story on UN Dispatch](#)



BREAKTHROUGHS

IMPACTS OF COVID-19

Highlighting the pandemic's impact on protected lands and waters

In a special issue of the scientific journal Parks, Conservation International (CI) scientists co-authored a series of studies that document the damaging effects of the pandemic on nature conservation and underscore the critical role of nature in post-pandemic recovery.

A CI-led study found that more countries have rolled back, rather than supported, conservation efforts during the pandemic. Despite the central role of environmental degradation in increasing the risk of zoonotic disease outbreaks, 22 countries have proposed or advanced 64 decisions to roll back environmental protections or reduce related budgets during the COVID-19 pandemic. In addition, the study found that nine countries and the European Union pledged US\$ 12.7 billion to enhance, restore, or expand conservation areas, and ten countries pledged US\$ 14.4 billion of their recovery packages to nature-based solutions, green infrastructure, sustainable tourism, and green job creation.

In two additional studies, CI scientists and co-authors highlighted the link between the destruction of nature and the emergence of zoonotic diseases and proposed key actions governments could

take to ensure that their conservation areas stay protected. Recommendations include increasing collaboration with Indigenous peoples and local communities, strengthening tourism, and ensuring that government budgets support domestic conservation areas.

The COVID-19 crisis has revealed existing issues with conservation funding and provides an opportunity to build lasting change. Our research insights are now central to international conservation guidance, trainings, and advocacy efforts from local to global scales. “As we move forward from the pandemic as a global community, there is a great opportunity to rebuild economies in a way that values nature and those who depend on it, helping ensure a more equitable, sustainable, and better future for everyone,” said CI scientist Rachel Golden Kroner, a lead author and co-chair of the international task force that organized the special issue.

This *Parks* special issue emerged through the collaborative efforts of more than 150 conservation experts, including six from CI. More than 390 media outlets reported on the special issue and its findings, including Reuters, BBC, The Washington Post, and The Guardian.

READ THE PUBLICATIONS



Covid-era policies and economic recovery plans



Drivers and causes of zoonotic diseases: an overview



Building sustainable finance for resilient protected and conserved areas

BREAKTHROUGHS

WATER STEWARDSHIP

Identifying local solutions to the global water crisis

In a recent essay, Conservation International (CI) scientists warned that stewardship of freshwater ecosystems cannot be guided by the same planetary-scale principles that inform the fight against climate change. Solutions to the water crisis must be local, accounting for the ecology of individual watersheds and the concerns of local communities.

Our study, published in *Environmental Research Letters*, highlights the opportunity to focus on bottom-up solutions that account for local and regional context and respond to changing conditions. In particular, global actors should focus less on volumetric measures and more on issues like water governance.

Around the world, CI is responding to this need for context-specific solutions through training and application of the Freshwater Health Index (FHI). Using ecological data and surveys from local communities, the FHI can help businesses and governments identify specific vulnerabilities within a basin and make more informed conservation choices. In partnership with IHE Delft Institute for Water Education, CI recently developed and launched an online training on the fundamentals of freshwater health and FHI applications. Seven hundred participants from around the world enrolled, providing an opportunity to rapidly scale up FHI use and enhance ecosystem-based approaches to watershed management globally.

READ THE PUBLICATION

 [H2O ≠ CO2: framing and responding to the global water crisis](#)

 [Visit the FHI Website](#)

Source: Vollmer, et al. (2021). *Environmental Research Letters*

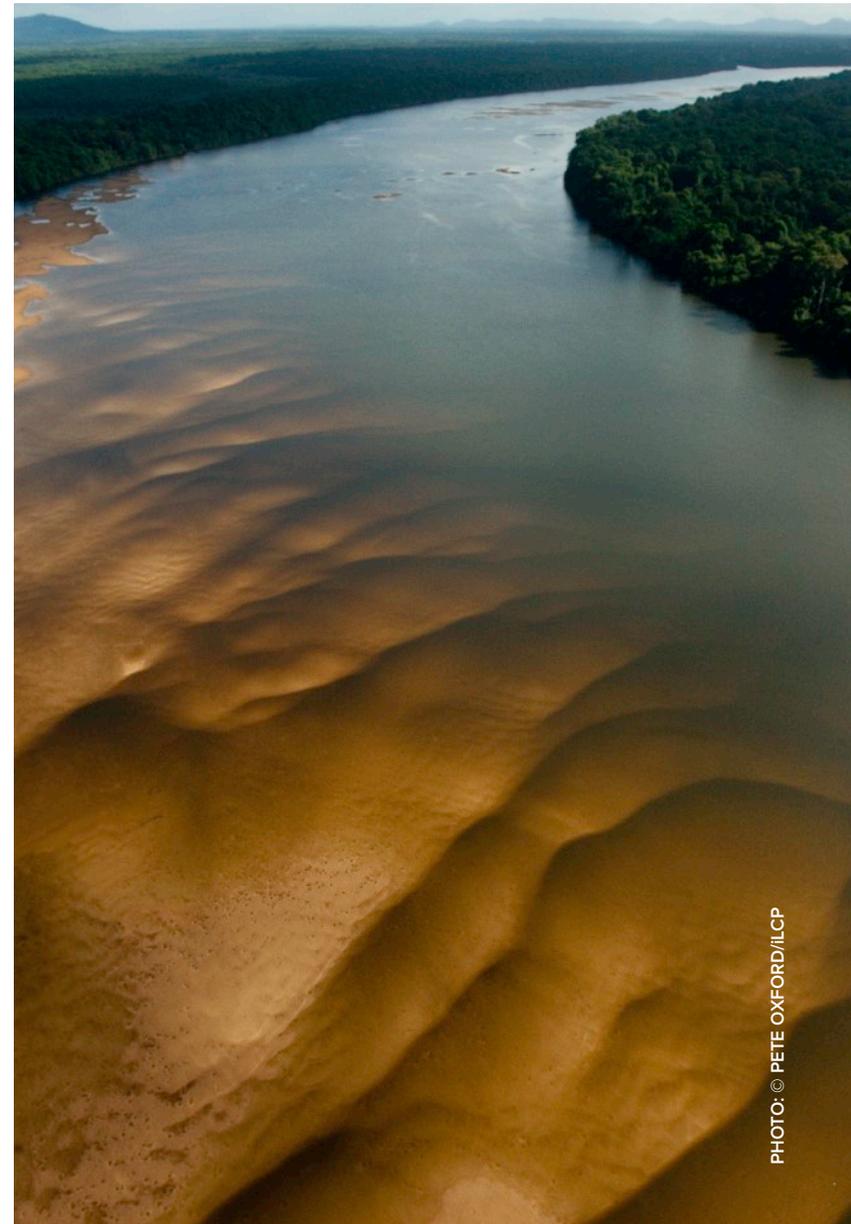


PHOTO: © PETE OXFORD/ILCP

BREAKTHROUGHS

WILDLIFE INSIGHTS

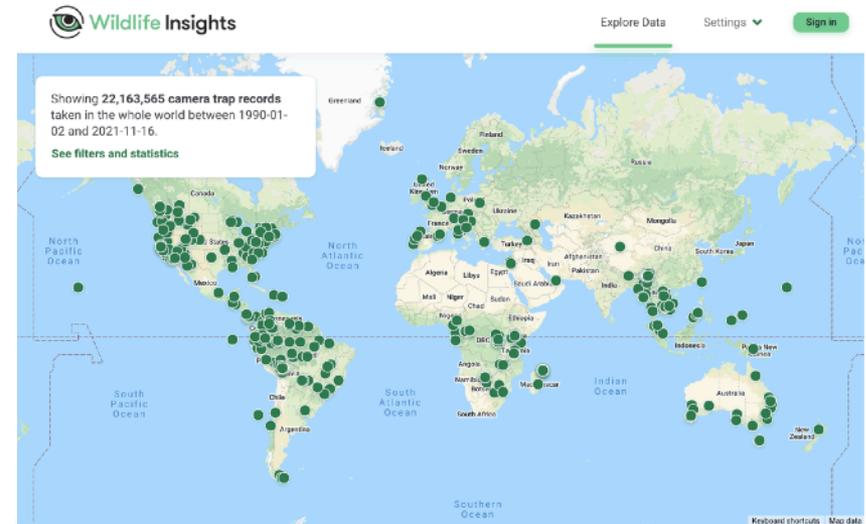
Redefining wildlife monitoring

Conservation International (CI) and partners publicly launched Wildlife Insights and have rapidly scaled adoption of this novel technology globally.

Wildlife Insights is an innovative platform that provides decision makers with near-real-time data on animal population dynamics through automated analyses of photographs from motion-sensing cameras. Since its public launch, Wildlife Insights has grown to host more than 22 million images from 65 countries, 400 projects, and more than 150 protected areas around the world. Powered by artificial intelligence, science-backed tools, and cloud technology, Wildlife Insights provides novel insights that enable data-driven decision-making locally and globally.

Wildlife Insights was released as a subscription software, with most users eligible for free use and others paying an annual subscription. Fees from paying clients already cover 15 percent of core operating costs, placing Wildlife Insights on a path to financial sustainability. In the coming years, Wildlife Insights will continue to promote uptake in the world's largest protected areas and most biodiversity rich landscapes — targeting an ambitious 2,000 protected areas by 2025.

 [Visit Wildlife Insights Website](#)



Showing **22,163,565** camera trap records
of **any species** ▼
in the **whole world** ▼
taken between **1990-01-02** ▼
and **2021-11-16** ▼
and part of **any project** ▼

Advanced filters

Results may include identifications assigned by computer vision that have not been **verified** by the data provider.

2,132

Species



22,163,565

Total images



BREAKTHROUGHS

PROTECTED AREAS

Catalyzing conservation through rapid field assessments

Field surveys conducted by Conservation International's (CI's) Rapid Assessment Program (RAP) led to the creation of the Chuyapi Urusayhua Regional Conservation Area in Peru and the Guanay Protected Area in Bolivia.

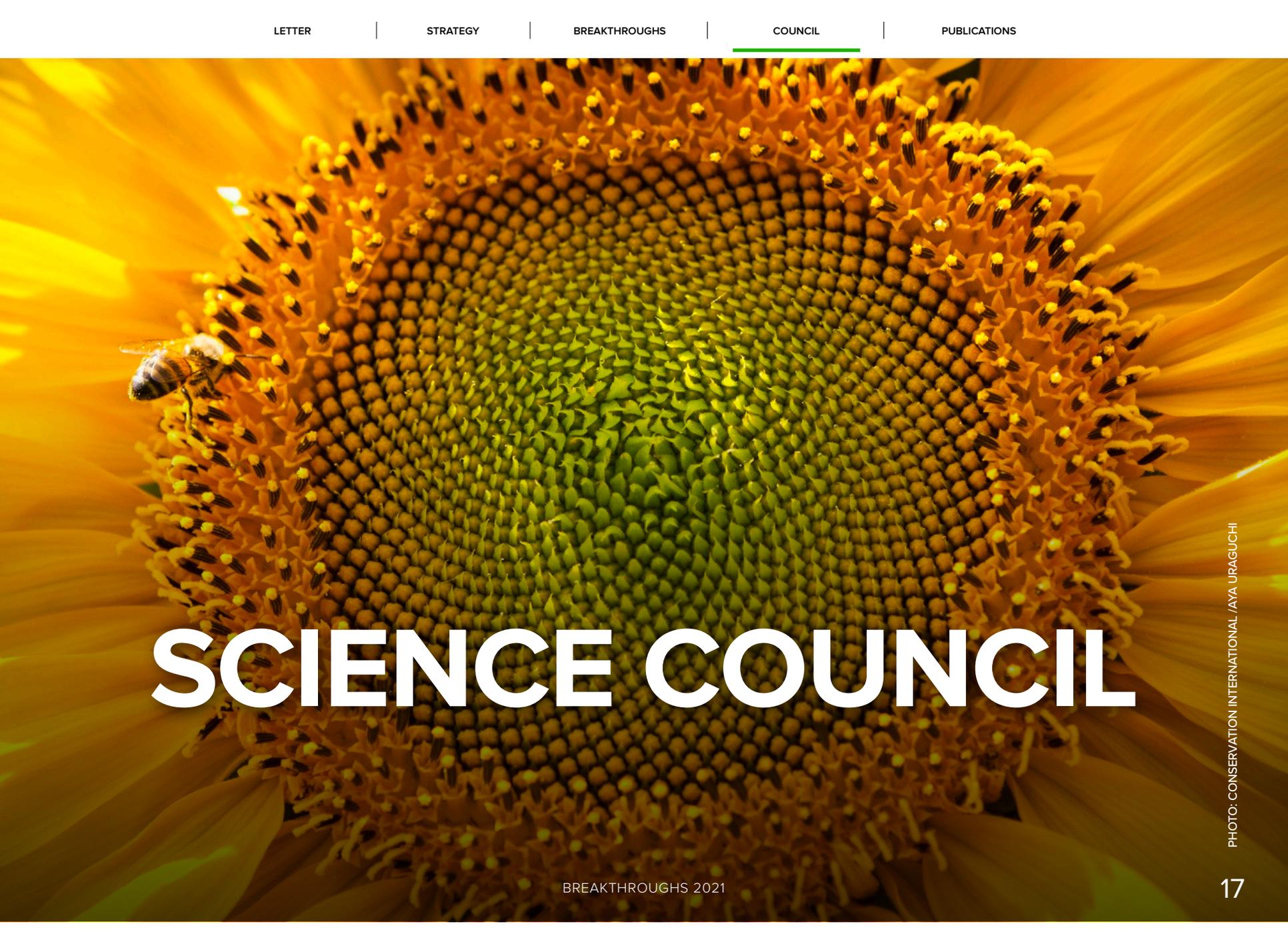
As a result of CI research eight years ago, the Peruvian government officially declared the 802 square kilometer (310 square mile) Chuyapi Urusayhua Regional Conservation Area. In 2013, our RAP team explored this pristine cloud forest and found 936 species of plants and 619 species of animals, including a new rodent, a new frog, and a new lizard. The new conservation area designation will protect this intact cloud forest, allowing species to move upslope in response to climate change and securing clean drinking water for more than 46,000 people living nearby.

A 2017 RAP survey of the Zongo Valley cloud forests near La Paz, Bolivia, similarly led to establishment of the Guanay Protected Area and ongoing efforts with local communities to create a second conservation area. Our team discovered 20 species new to science (including a frog and two snakes) and rediscovered four species previously believed to be extinct. In addition to its high endemism and unique biodiversity, the Zongo Valley provides essential ecosystem services, including drinking water and 11 percent of Bolivia's electricity through sustainable hydropower. The 1,100 square kilometer (425 square mile) Guanay Protected Area will safeguard cloud and montane forests and their irrecoverable carbon stores, ecosystem services, and unique wildlife.



In Bolivian Andes, new protected area offers 'a breath of fresh air'





SCIENCE COUNCIL

SCIENCE COUNCIL

The Conservation International (CI) Science Council recognizes and convenes the most passionate and generous supporters of science at CI. Individually and collectively, Science Council members further CI's science initiatives.

Steve Bell (chair)

Founder, One Cool Planet
Member, CI Leadership Council
Estes Park, Colorado

Mohamed Bakarr

Senior Environmental Specialist,
Global Environment Facility
Washington, District of Columbia

Lyda Hill

Founder, Lyda Hill Philanthropies
Dallas, Texas

Aileen Lee

Chief Program Officer,
Environmental Conservation,
Gordon and Betty Moore Foundation
Member, CI Leadership Council
Palo Alto, California

Rebecca Moore

Director, Google Earth, Earth Engine
and Geo for Good, Google
Mountain View, California

Peter Schlosser

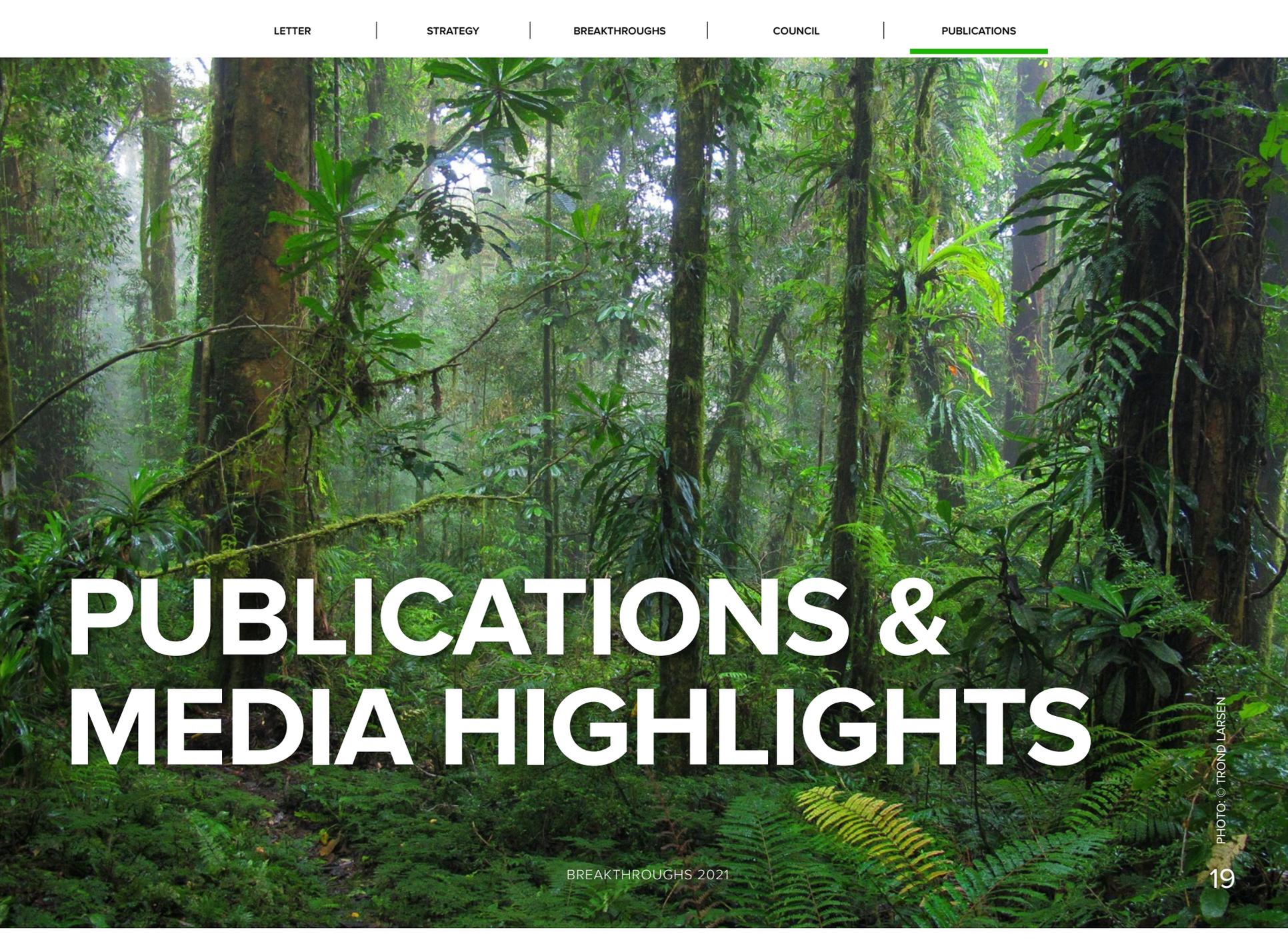
Vice President and Vice Provost of
the Global Futures Initiative, Arizona
State University
Tempe, Arizona

Jorgen Thomsen

Director, Climate Solutions,
MacArthur Foundation
Chicago, Illinois

Katie Vogelheim

**2020 Stanford Distinguished
Career Institute Fellow**
Chair, CI Leadership Council
Tiburon, California



PUBLICATIONS & MEDIA HIGHLIGHTS

2021 PUBLICATIONS & MEDIA HIGHLIGHTS

The Moore Center for Science at Conservation International (CI) is one of the world's premier conservation research units. Our scientists and experts publish breakthrough research and grow the body of evidence upon which humanity depends.

To date, CI has published more than 1,200 peer-reviewed articles, many in leading journals like *Science*, *Nature*, and the *Proceedings of the National Academy of Sciences*. On average, each of our scientific papers is cited more than 45 times by other scholars – more than any other U.S. conservation organization and leading universities like Harvard, Yale, Duke, and Stanford.

46

peer-reviewed publications

41

additional manuscripts currently in review

360

headlines

FROM TOP-TIER MEDIA OUTLETS ON CI RESEARCH, INCLUDING THE GUARDIAN, WASHINGTON POST, NY TIMES, BBC AND REUTERS

28+

million people reached

ON SOCIAL MEDIA INCLUDING TWITTER, FACEBOOK, AND LINKEDIN

NOTE: NAMES IN **BOLD** ARE CI AUTHORS

A global review of ecological fiscal transfers

Busch, J., Ring, I., Akullo, M., Amarjarga, O., Borie, M., Cassola, R.S., Cruz-Trinidad, A., Droste, N., Tri Haryanto, J., Kasymov, U., Viktorivna Kotenko, N., Lhkagvadorj, A., Lima De Paulo, F.L., May, P. M., Mukherjee, A., Mumbunan, S., Santos, R., Tacconi, L., Verde Selva, G., Verma, M., Wang, X., Yu, L., Zhou, L. 2021. *Nature Sustainability*.

<https://doi.org/10.1038/s41893-021-00728-0>

A metric for spatially explicit contributions to science-based species targets

Mair, L., and 87 other authors (incl. **Hole, D. G.** and **Cox, N. A.**). 2021. *Nature Ecology & Evolution*, 5, 836–844.

<https://doi.org/10.1038/s41559-021-01432-0>

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Active Restoration Leads to Rapid Recovery of Aboveground Biomass but Limited Recovery of Fish Diversity in Planted Mangrove Forests of the North Brazil Shelf

Ram, M. A., Caughlin, T., **Roopsind, A.** 2021. *Restoration Ecology*, 29(5).

<https://doi.org/10.1111/rec.13400>

Adapting transformation and transforming adaptation to climate change using a pathways approach

Colloff, M.J., Gorddard, R., Abel, N., Locatelli, B., Wyborn, C., Butler, J.R., Lavorel, S., van Kerckhoff, L., Meharg, S., Múnera-Roldán, C., Bruley, E., **Fedele, G.**, Wise, R.M., Dunlop, M. 2021. *Environmental Science & Policy*, 124, 163–174.

<https://doi.org/10.1016/j.envsci.2021.06.014>

Areas of global importance for conserving terrestrial biodiversity, carbon and water

Jung, M., and 52 other authors (incl. **Hannah, L.**, and **Roehrdanz, P.R.**). 2021. *Nature Ecology & Evolution*, 5, 1499–1509.

<https://doi.org/10.1038/s41559-021-01528-7>

Building sustainable finance for resilient protected and conserved areas: lessons from COVID-19

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<http://doi.org/10.1080/17524032.2020.1862890>

Connectivity and conservation of Western Chimpanzee (*Pan troglodytes verus*) habitat in Liberia

Frazier, A.E., **Honzák, M.**, Hudson, C., Perlin, R., Tohtsonie, A., Gaddis, K.D., de Sousa, C., Larsen, T.H., Junker, J., Nyandwi, S., Trgovac., A.B. 2021. *Diversity and Distributions*.

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Chaplin-Kramer, R., Brauman, K. A., Cavender-Bares, J., Díaz, S., Duarte, G.T., Enquist, B.J., Garibaldi, L.A., Geldmann, J., Halpern, B.S., Hertel, T.W., Houry, C.K., Krieger, J.M., Lavorel, S., Mueller, T., Neugarten, R.A., Pinto-Ledezma, J., Polasky, S., Purvis, A., Reyes-García, V., **Roehrdanz, P.R.**, Shannon, L.J., Shaw, M.R., Strassburg, B.B., Tylianakis, J.M., Verburg, P.H., Visconti, P., Zafra-Calvo, N. 2021. *Nature Ecology & Evolution*.

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<https://doi.org/10.3389/fmars.2021.663460>

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<https://doi.org/10.1111/cobi.13696>

COVID-era policies and economic recovery plans: are governments building back better for protected and conserved areas?

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Napolitano Ferreira, M., Elliott, W., **Golden Kroner, R.**, Kinnaird, M.F., Prist, P.R., Valdujo, P., Vale, M.M. 2021. *PARKS*, 27, 15–24.

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Frontiers of protected areas versus forest exploitation: Assessing habitat network functionality in 16 case study regions globally

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Higher temperatures are associated with reduced nestling body condition in a range-restricted mountain bird

Oswald, K.N., Smit, B., Lee, A., Peng, C.L., **Brock, C.**, Cunningham, S.J. 2021. *Journal of Avian Biology*.

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We imagine a healthy, prosperous world in which societies are forever committed to caring for and valuing nature, for the long-term benefit of people and all life on Earth.

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