01/31/2022
TON-YEAR
ACCOUNTING

03/30/2022
FORESTS AND FIRE
GHG ACCOUNTING

05/17/2022
SCOPING PLAN
COMMENTS

04/08/2022
CRYPTO AND
OFFSETS

05/24/2022
RISKS
WORKSHOP

06/30/2022
DOWNSCALING
CMIP6

09/19/2022
CDR
VERIFICATION
FRAMEWORK

07/13/2022
CDR BARRIERS
SURVEY

10/13/2022
CDR PRIMER
IN PRINT

11/02/2022
CDR VERIFICATION
CONFERENCE

2022 Report

(carbon)plan

The year in review

So much happened this year in climate science and policy — and we've been responding on several fronts.

In the world of forest carbon offsets, we anticipated the emergence of "ton-year accounting" as a controversial approach for valuing temporary carbon storage, and we helped raise awareness around the problems with these methods. We also continued to analyze and monitor the impact of fires on forest carbon. While our analyses raise concerns around temporary carbon storage in the context of offsetting, we hope they motivate new ideas about how to value and encourage these practices through other policy strategies. In the offsets market more broadly, we have been closely tracking emerging trends, responding to problematic practices — like the use of crypto for offsets — and engaging with regulatory opportunities.

In an area of promise and potential, we were excited by the launch of Frontier, an advanced market commitment for carbon removal that grew out of the Stripe Climate program. Our teams together developed a framework for verifying carbon removal outcomes and helped bring the community together with the goal of creating a robust ecosystem around carbon removal that avoids the problems of legacy offsets. We're also continuing deep dives on specific carbon removal pathways, and building tools that characterize opportunities, costs, and challenges.

As part of a newer program area on climate risks, we released a global dataset of downscaled climate models, and we hosted an interdisciplinary workshop on climate risk and financial regulation. We're now developing new directions based on these initial efforts.

All of this work was enabled by our incredible, growing policy and technology teams, as well as a collection of software tools for reproducible data analysis and interactive data visualization. Through grant-funded projects with NASA and NSF we are further developing high-leverage tools for climate science.

Our efforts have been covered broadly in the press, and we're grateful to the investigative journalism community for helping hold climate solutions accountable to scientific reality. Across the public and private sector, we're excited that organizations are increasingly asking questions about what's working and what's not — drawing on, or responding to, our work.

And there's so much more to do.

Sincerely,

JEREMY FREEMAN
Executive Director

What we do

Addressing the climate crisis requires action on several fronts. In addition to rapidly achieving deep emission reductions, we also need gigaton-scale carbon removal and sound strategies for adapting to climate change. Our solutions must respect science and support just outcomes. We no longer have time for approaches that don't work.

CarbonPlan is a research nonprofit that analyzes the design and implementation of climate programs across the public and private sectors. Our work focuses primarily on carbon offsets, carbon removal, and climate risks. In all three areas, we aim to ensure the scientific integrity and transparency of climate services and solutions.

We research fundamental topics in climate science relevant to both mitigation and adaptation

We work with companies, non-profits, and government organizations to develop robust climate policy and programs

We build open software tools and resources to surface critical dimensions of climate solutions

Who we are

Team

ANDERSON BANIHIRWE
Software Engineer

BECKY HURST
Operations Manager

DANNY CULLENWARD
Policy Director

FREYA CHAY
Program Manager

GRAYSON BADGLEY
Research Scientist

JEREMY FREEMAN
Executive Director

KATA MARTIN
Product Lead

MAX JONES
Machine Learning Engineer

ORIANA CHEGWIDDEN
Research Scientist

RAPHAEL HAGEN
Data Engineer

SADIE FRANK
Program Manager

SAGE ORTIZ
Operations Associate

Board

ARJUNA DIBLEY
U. of Melbourne / U. of Oxford

GERNOT WAGNER
Columbia Business School

JEREMY FREEMAN
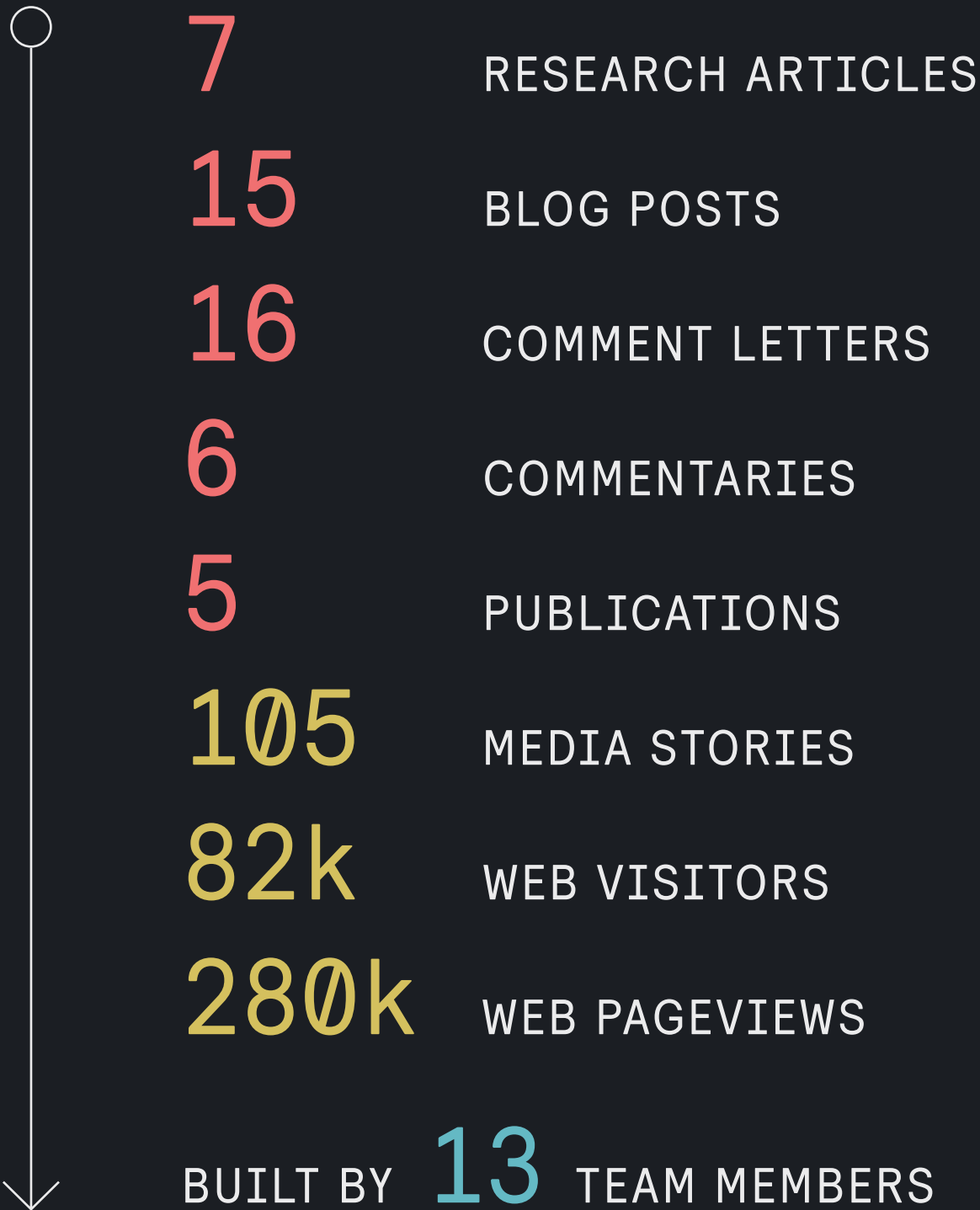CarbonPlan

KELLY GANNON
NDWA Labs

TRACY TEAL
Posit (formerly RStudio)

By the numbers

7 RESEARCH ARTICLES

15 BLOG POSTS

16 COMMENT LETTERS

6 COMMENTARIES

5 PUBLICATIONS

105 MEDIA STORIES

82k WEB VISITORS

280k WEB PAGEVIEWS

BUILT BY **13** TEAM MEMBERS

Press coverage

A core part of our strategy is building momentum in the media around key issues in climate science and policy. These efforts help shift public narratives and ensure solutions pursued in the public and private sector are held accountable to the realities of climate science.

This year 105 stories covered our work. Media coverage spanned print, web, podcast, and national television across 56 unique venues, featuring 6 members of our team.

TIME	NATIONAL GEOGRAPHIC	The Washington Post	CBS NEWS
The Atlantic	The New York Times	MIT Technology Review	Grist
HBO	Bloomberg	The Verge	FT FINANCIAL TIMES

Visit carbonplan.org/press for a complete up-to-date list of our media coverage.

What we did

Articles

Commentary

What we did (cont.)

Publications

Economic and biophysical limits to seaweed-based climate solutions ↗

Ocean solutions in the carbon market ↗

Future climate risks from stress, insects and fire across US forests ↗

California's forest carbon offsets buffer pool is severely undercapitalized ↗

Using remote sensing to quantify the additional climate benefits of California forest carbon offset projects ↗
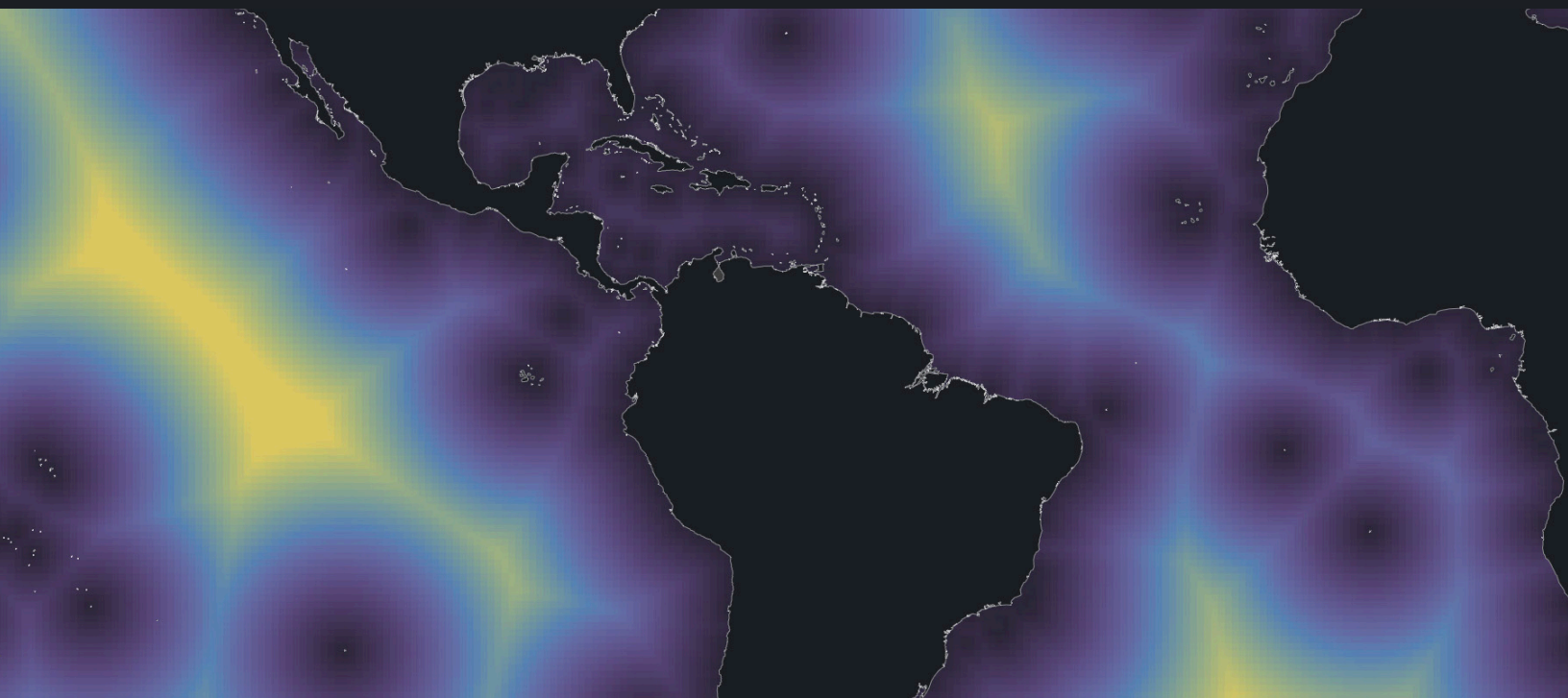
Tools

CDR verification framework ↗
Exploring CDR pathway uncertainties

CMIP6 downscaling ↗
Data browser and interactive map

Seaweed farming map ↗
Mapping costs and potential benefits

Compliance users ↗
Connecting offsets to their users

One input layer underlying our seaweed farming map tool, showing distance in the ocean to the nearest port

What we did (cont.)

Comment letters

UNFCCC Article 6.4 Supervisory Body ↗
re: Carbon removal guidance

Australian Independent Review Panel ↗
re: Climate integrity of ACCUs

White House OSTP ↗
re: Digital assets

NASA ↗
re: Open source science

Science Based Targets initiative ↗
re: Carbon removal guidance

European Commission ↗
re: Certifying carbon removal

Federal Insurance Office ↗
re: Climate-related financial risk

California Air Resources Board ↗
re: Forest carbon offsets workshop

Washington Department of Ecology ↗
re: California forest carbon offsets

Verra ↗
re: NCX's harvest deferral methodology

Verra ↗
re: Proposed updates to VCS Program

Voluntary Carbon Markets Integrity Initiative ↗
re: Provisional Claims Code of Practice
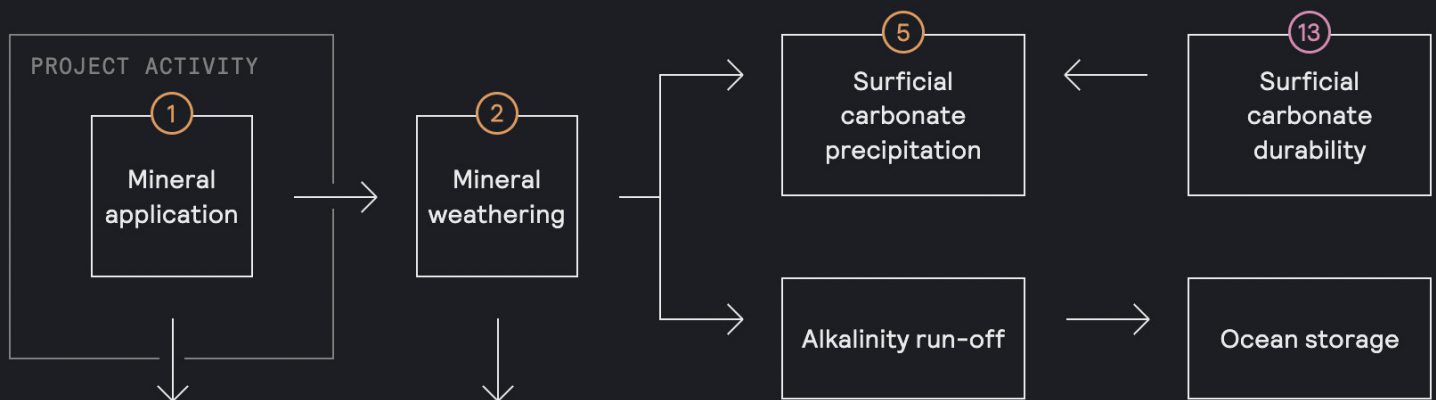
U.S. Securities and Exchange Commission ↗
re: Climate-related financial disclosures

Office of the Comptroller of the Currency ↗
re: Climate-related financial risk

U.S. Commodity Futures Trading Commission ↗
re: Climate-related financial risk

Greenhouse Gas Protocol ↗
re: Draft Land Sector and Removals Guidance

Carbon removal

Portion of the enhanced weathering pathway diagram from our CDR Verification Tool

As the long-duration carbon removal ecosystem begins to scale, we need to design quality-control systems that ensure high-integrity outcomes and avoid the problems of legacy carbon offsets. To better understand the barriers to responsibly scaling the CDR industry, we conducted a survey of 37 stakeholders and released a report documenting our key findings, including around the perceived need for standards and verification. We also worked collaboratively with the team at Stripe Climate to develop a framework for carbon removal verification. The framework includes analysis of uncertainties associated with different carbon removal approaches and introduces a new metric — the Verification Confidence Level — to capture key differences across pathways. Building off of the verification framework, we helped host a three-day workshop that brought together 70 organizations across the CDR landscape to discuss verification system design and actionable next steps. Separately, we published a letter with 16 organizations making recommendations to the Science Based Targets initiative (SBTi) on the treatment of carbon removal in their net-zero standard. Alongside working on these cross-cutting issues of governance and standards, we are also continuing deep-dive research into specific areas of carbon removal. This year we released an interactive tool mapping the cost and potential of seaweed farming methods in collaboration with researchers at UC Irvine and NCAR. Finally, we were excited to help finish the print version of the CDR Primer, the first-ever textbook on carbon dioxide removal.

CDR BARRIERS SURVEY ↗

CDR VERIFICATION FRAMEWORK ↗

FRONTIER BLOG POST ↗

COMMENTS TO SBTI ↗

SEAWEED FARMING POTENTIAL ↗

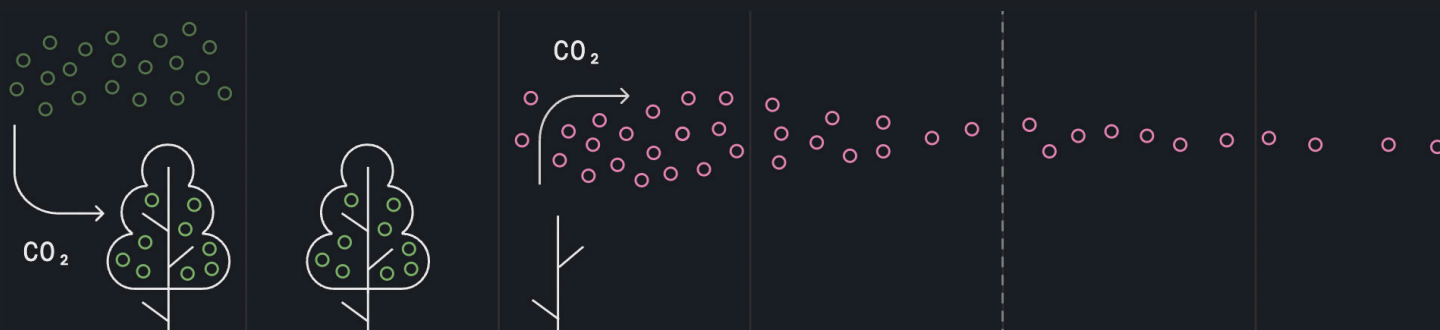CDR PRIMER ↗

Temporary storage

Illustration from our explainer on ton-year accounting

For a carbon offset to counteract fossil CO_2 emissions, carbon storage must be effectively permanent. But many nature-based offsets instead promise temporary carbon storage on the order of only 10-100 years, subject to loss from drought, disease, and forest fires. One approach to managing threats like fire is an insurance-like mechanism called a "buffer pool." Our analysis of California's forest offsets program showed that in less than 10 years, wildfires have depleted the buffer pool credits meant to protect against fire-related losses for a century. This work received extensive media coverage, including in National Geographic, the Financial Times, and as the subject of a nationally televised segment on CBS Morning News. We also conducted a suite of research and policy projects focused on a concept called "ton-year accounting," via which some companies are marketing "permanent" carbon offset credits based on bundles of very short-term storage commitments. We showed how ton-year accounting methods are based on an oversimplification of physical climate science and lead to higher global temperatures when used to offset fossil carbon emissions. We also critiqued the use of ton-year accounting by the startup NCX, which had proposed to issue credits for one-year timber harvest delays via a methodology submitted to the largest carbon offset registry, Verra. We sent comment letters to the United Nations' carbon trading supervisory body and Verra opposing the adoption of these methods. Verra subsequently announced that they will not move forward with incorporating ton-year accounting into their standards, and the Integrity Council for the Voluntary Carbon Market similarly indicated it would exclude ton-year accounting from its forthcoming standards.

BUFFER POOL
ANALYSIS ↗

TON-YEAR
ACCOUNTING
EXPLAINER ↗

CRITIQUE OF
NCX'S METHOD ↗

COMMENTS TO
VERRA ON NCX ↗

COMMENTS TO
VERRA ON
TON-YEAR ↗

NATIONAL
GEOGRAPHIC
COVERAGE ↗

CBS MORNING
NEWS STORY ↗

Offsets oversight

We helped provide oversight of the carbon offsets market on several fronts by weaving together research, policy engagement, and investigative journalism. Most prominently, we consulted with the producers of Last Week Tonight with John Oliver on their carbon offsets episode. We continued our work tracking private sector standards, providing detailed comments to and commentary on the Integrity Council for Voluntary Carbon Markets (which is setting sell-side offset credit quality standards) and the Voluntary Carbon Market Integrity Initiative (which is setting buy-side marketing standards). We published academic research that used remote sensing to document non-additionality outcomes in California's forest carbon offsets program, and sent extensive comments to Washington state's climate regulator, which adopted California's program despite its well-documented shortcomings.

In addition to our oversight work in the conventional carbon markets, we also published research documenting concerning practices involving blockchain-based offset credits. Our research showed how low-quality offset credits were being transferred from Verra to Toucan, a crypto company that creates "tokenized" carbon credits from standard registry listings. Speculative interest from crypto investors helped resurrect millions of "zombie" credits from older offset projects that had been excluded from conventional markets due to their low quality. Bloomberg and Time covered the release of our research, which we summarized in a comment letter to the White House Office of Science and Technology Policy. We also shared our technical expertise with a team of Thomson Reuters Foundation journalists investigating another tokenization scheme called Moss. In response to public pressure, Verra announced that they would restrict tokenization practices, while the White House OSTP report on crypto correctly concluded that blockchain technologies are inapt as solutions to well-known problems with carbon offsets. As carbon markets continue to grow, our oversight work will need to grow with it — and we'll be there to hold the line on scientific integrity and transparency.

LAST WEEK TONIGHT ↗

INTEGRITY COUNCIL COMMENTARY ↗

COMMENTS TO WASHINGTON ↗
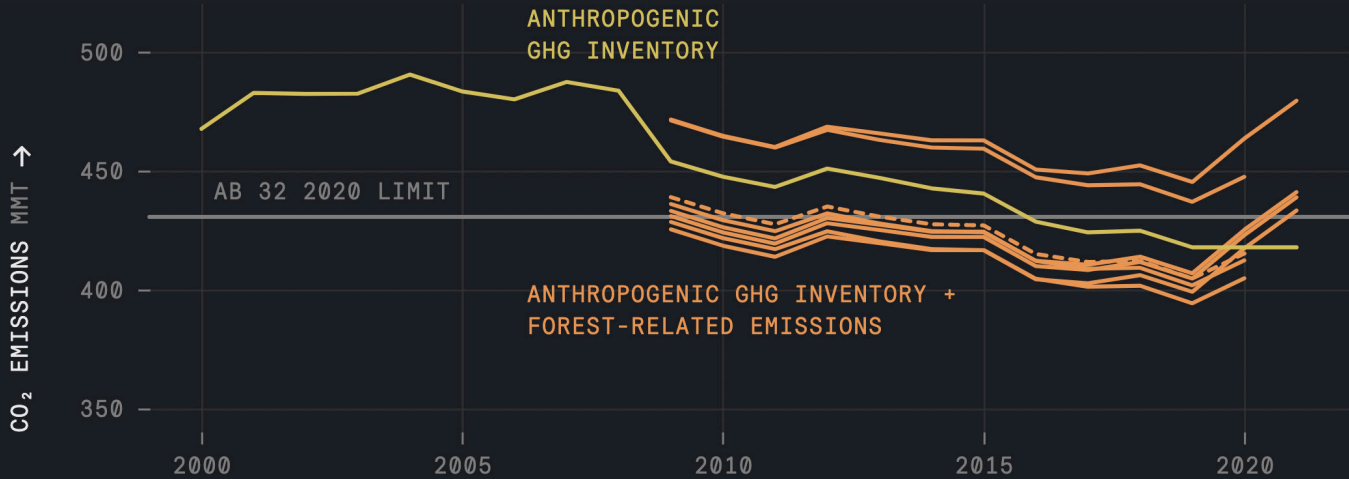
ZOMBIES ON THE BLOCKCHAIN ↗

BLOOMBERG COVERAGE ↗

TIME MAGAZINE COVERAGE ↗

COMMENTS TO OSTP ↗

Illustration from our "Zombies on the blockchain" article

Net-zero in California

Figure — CO₂ Emissions chart

Y-axis: CO₂ EMISSIONS MMT with values 350, 400, 450, 500

X-axis: 2000, 2005, 2010, 2015, 2020

Labels on chart: ANTHROPOGENIC GHG INVENTORY; AB 32 2020 LIMIT; ANTHROPOGENIC GHG INVENTORY + FOREST-RELATED EMISSIONS

Analysis of GHG inventories under different land sector modeling assumptions

Greenhouse gas accounting in the land sector played a key role in California climate policy this year. In March, we wrote an article on technical challenges that must be addressed to integrate forest carbon removal and forest fire emissions in California's official greenhouse gas inventory, which the state has promised to do as it pursues its goal of achieving net-zero emissions by 2045. We showed why it might be wiser to manage energy- and land-sector emissions separately, rather than relying on the forest sector to compensate for emissions that aren't abated in the energy sector. When California released its draft scoping plan over the summer, our earlier analysis helped us identify and document several key errors in how the plan modeled the land sector; those errors, in turn, meant the plan's already speculative requirements for carbon removal would be even higher — and even more unrealistic. Our concerns with the draft scoping plan quickly got significant attention, leading to an editorial in The Los Angeles Times and a Volts podcast with David Roberts. Our policy team actively coordinated with a broad coalition of NGOs in California to advance a more ambitious and realistic scenario in the revised scoping plan, and our media coverage led to several opportunities to engage directly with members of the California Air Resources Board, the appointed officials overseeing the staff-level work. Unfortunately, very little changed in the final scoping plan, which relies on proprietary modeling to justify what can only be described as predetermined outcomes.

FIRES, FORESTS, AND GHG INVENTORIES IN CALIFORNIA ↗

SCOPING PLAN COMMENTARY ↗

LOS ANGELES TIMES EDITORIAL ↗

DAVID ROBERTS PODCAST ↗

Financial regulation

Illustration used in our work on climate risks and financial regulation

This was a watershed year for U.S. climate-related financial regulation. Sparked by an executive order from the Biden Administration, federal financial regulators drafted rules, released requests for information, and held briefings on climate considerations across insurance, banking, and securities and commodity market regulation. We participated extensively in regulatory processes to elevate how transparency and scientific integrity must be centered across carbon markets and management of climate risks — key areas of importance to financial regulators. This included writing policy commentaries on carbon offset disclosure, and responding to requests for comment at the Securities and Exchange Commission (SEC), Commodity Futures Trading Commission (CFTC), and the Office of the Comptroller of the Currency (OCC). Alongside our responses to public comment requests, we also supported the broader stakeholder landscape by informing coalition advocacy efforts with our research, and directly engaging with agencies and policymakers.
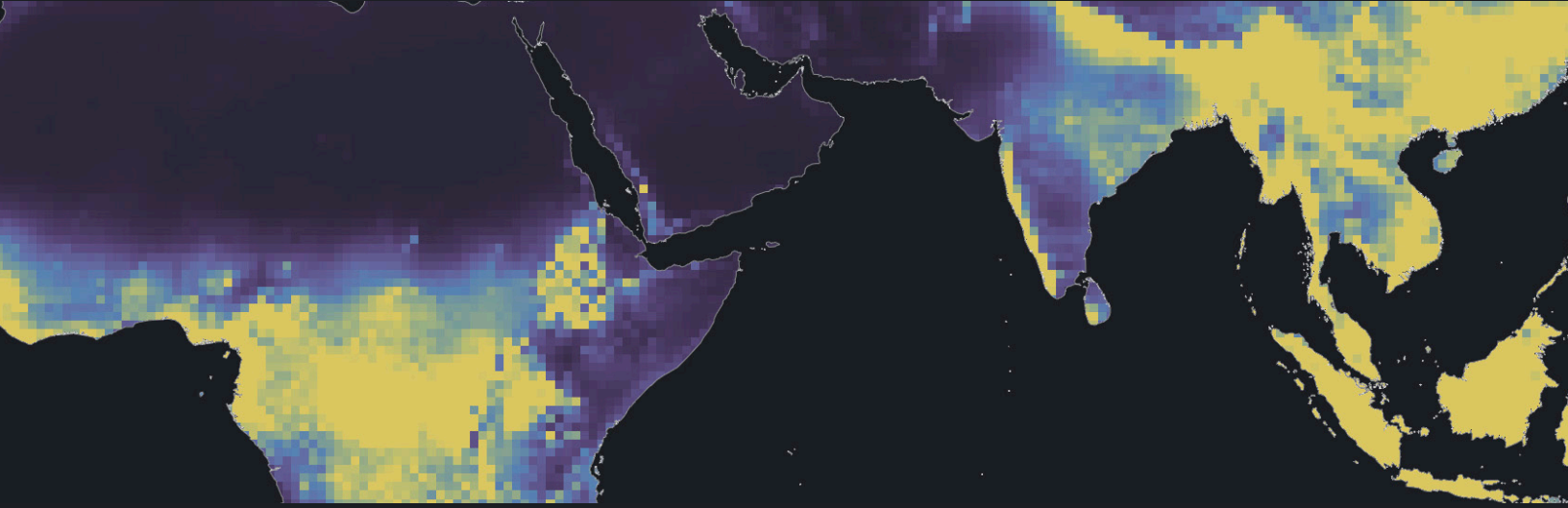
OFFSETS
DISCLOSURE
COMMENTARY ↗

COMMENTS
TO THE SEC ↗

COMMENTS
TO THE CFTC ↗

COMMENTS
TO THE OCC ↗

Climate risks

Example map of downscaled precipitation projections

The changing climate now poses risks to every corner of the natural and built environments. While recognition of these risks is growing, significant gaps remain between physical climate science, impact modeling, and the needs of public and private sector decision makers. One key step in analyzing climate risks involves taking projections from global climate models (GCMs) and "downscaling" them to yield datasets that are spatially and temporally tuned for detailed projection of impacts and risks. We released a new global downscaled climate data product spanning multiple downscaling methods, alongside an interactive mapping tool for inspecting, exploring, and comparing the data, and open source tools for reproducing the results. We hope this release enables important comparisons and evaluation of this critical step in climate impacts analysis, and the dataset and codebase has already been used by researchers in water resources and agricultural planning. In parallel, we wrote a policy commentary explaining why climate data matter to climate-related financial risk assessments, arguing for the urgent need to improve the accessibility, availability, and transparency of climate risk data. Finally, we hosted an interdisciplinary workshop with the Environmental Defense Fund (EDF) and the Initiative on Climate Risk and Resilience Law (ICRRL) on physical climate risk and financial regulation, bringing together former regulators and climate risk experts to find new opportunities for collaboration.

CMIP6 DOWNSCALING EXPLAINER ↗

CMIP6 DOWNSCALING TOOL ↗

CLIMATE RISK DATA COMMENTARY ↗

WORKSHOP SUMMARY ↗

Open source tools

```python
from xpersist import XpersistResult
from prefect import task
import xarray as xr

@task(
    target="bar.zarr",
    result=XpersistResult(
        store,
        serializer="xarray.zarr",
        serializer_dump_kwargs={"mode": "w"}
    ),
)
def compute_expensive_result(ds):
    return ds.groupby("time.month").mean()
```

Sample code from our post on cloud-based pipelines

Leveraging and contributing to open source ecosystems remains a key component of our work. This year we continued building tools and resources spanning several areas of data production and management, model development, data analysis, cloud computing, and visualization. We contributed extensively to Pangeo Forge, a new platform for the production of analysis-ready, cloud-optimized (ARCO) datasets. Through this effort we are helping generate findable, accessible, interoperable, and reusable (FAIR) data and support broader availability of climate data. In addition to building tools for data production and access, we released resources for large-scale data analysis, including a tutorial at the 2022 Scientific Computing with Python conference and a blog post covering scalable, cloud-based climate model downscaling pipelines. As part of the Pangeo-ML project, we have both contributed to core scientific Python tools and have also begun building bridges between machine learning frameworks and tools for analyzing large, gridded datasets. We hope these tools will enable several climate science and data applications moving forward.
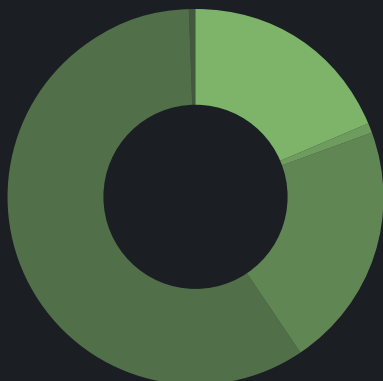
PANGEO FORGE ↗

XBATCHER ↗

SCIPY 2022 HIGHLIGHTS ↗

RECOMMENDATIONS FOR CLOUD-BASED PIPELINES ↗

Finances

We are committed to financial transparency, and to maximizing the impact of our generous donors. Here we provide data on our 2022 revenue and expenses by category. The same data will also be released in 2023 as part of our public 2022 tax filings.
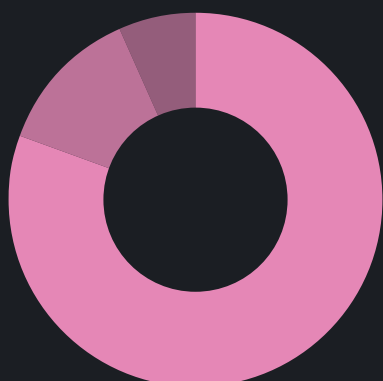
Revenue

$3,034,817

- Project-specific (contracts) (20.7%)
- Project-specific (grants) (4.0%)
- Unrestricted (individuals) (18.3%)
- Unrestricted (foundations + corporations) (56.7%)
- Consulting (0.3%)
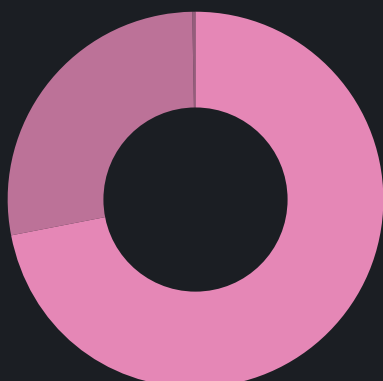
Expenses (by type)

$2,476,273

- Staff (salary + benefits) (77.4%)
- Services (legal + design + consulting) (14.2%)
- Operations (computing + SaaS) (8.4%)

Expenses (by area)

$2,476,273

- Program work (75.6%)
- Administration and fundraising (24.3%)
- Decision support (0.1%)

Thank you

REPORT / 2022

Our work would not be possible without the generous support of our donors and partners. Here we provide a list of funding sources in 2022 greater than $1,000, all of which are included in the totals listed previously. Some funding in 2022 supported projects that were not completed or announced in 2022. Those sources are included in our 2022 revenue totals, but not listed below, and will be in next year's report.

See carbonplan.org/funding for an up-to-date list reflecting all funding sources.

Unrestricted

COLIN RUST + JEANNIE TSENG
PAMELA MENSCH
INCITE LABS
LIONEL DRIPPS + REBECCA RICE
ROVERE O'KELLEY FAMILY FUND
CALVIN FRENCH-OWEN
ROSS GARON + HONG SUH
CLIMATE COUSINS FOUNDATION
HAMPUS JAKOBSSON
AMBROSE CARR

VENKATESH + BALAJI SRINIVAS
ROBERT + MARTHA PARKE
CHAN ZUCKERBERG INITIATIVE
ADDITIONAL VENTURES
SBFF
PRESTON-WERNER FOUNDATION
SILICON VALLEY COMMUNITY FOUNDATION
MICHAEL HARM

Project-specific

THE UTILITY REFORM NETWORK
CLIMATEWORKS
ADDITIONAL VENTURES
XPRIZE
MICROSOFT AI FOR EARTH
NASA
COLUMBIA UNIVERSITY

Offset evaluation
Seaweed farming
CDR barriers survey
Review
CMIP6 downscaling
Pangeo ML
LEAP (Learning the Earth with Artificial Intelligence and Physics)

CARBONPLAN   (18/18)