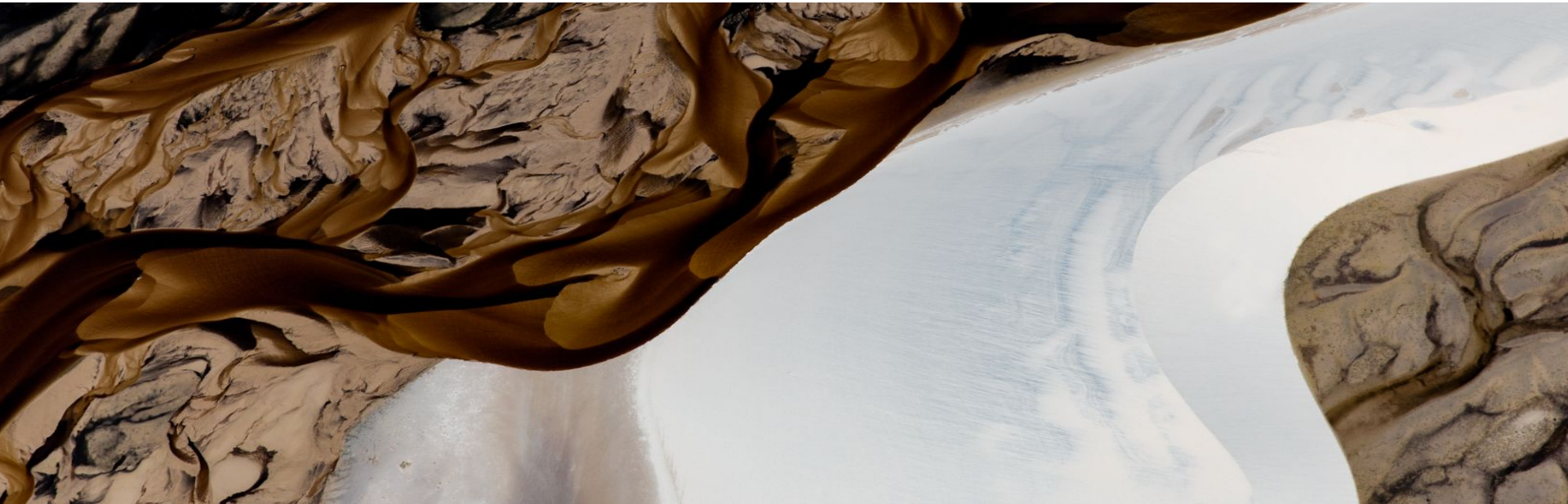# Mapping the Open Source Ecosystem for Climate Science and Sustainable Technology

Richard Littauer, Tobias Augspurger, Alex Stinson, Pierre Vogler-Finck, Andrew Nesbitt, Chris Harris

https://opensustain.tech

Why are we talking here today?

- The climate crisis is urgent, deadly, and difficult.
- Solutions will involve collaboration and ingenuity.
- Open source software offers the best possible chance of enabling a fast, effective response.
- We want to facilitate its discovery, maintenance and use.

OpenSustain.tech is the largest, curated, open database
of OSS used in climate science.

Ko wai a Richard Littauer, ahakoa?

- Ko Richard Graham Littauer tōku inga
- No Europe oku tupuna
- Kei te noho au ki Te Whanganui-a-Tara.
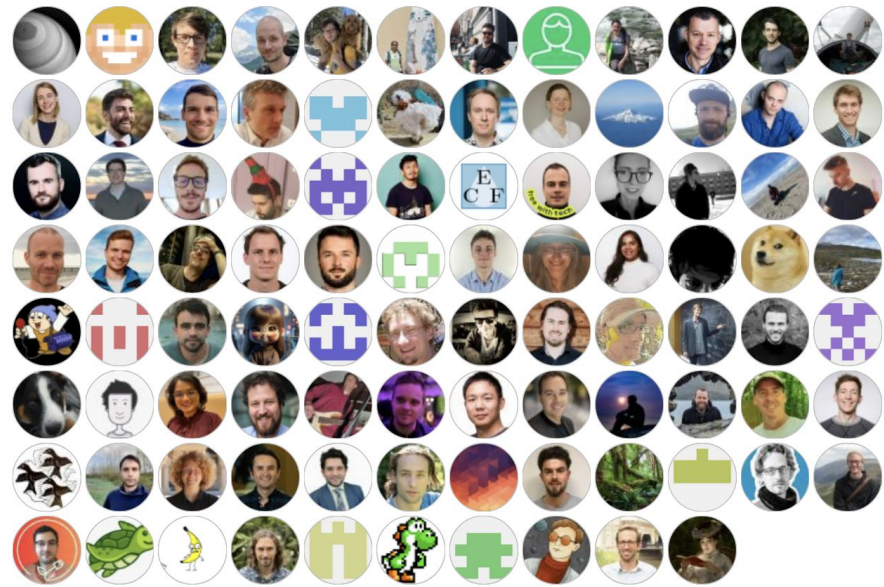- Kei te ako au i te herenga waka.
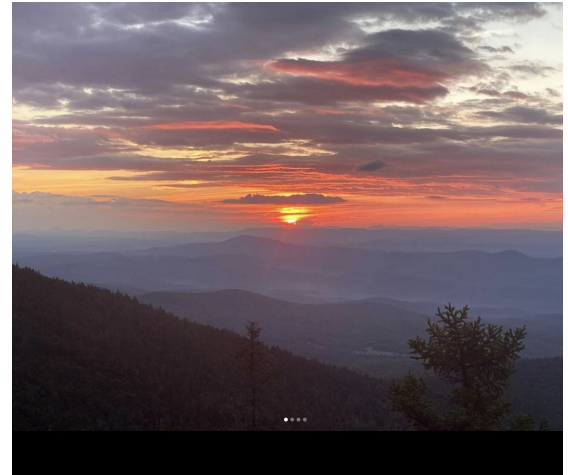
Who are we?

Richard Littauer

- CURIOSS, SustainOSS, Te Herenga Waka Victoria University of Wellington, PythonNZ

& Tobias Augspurger, Alex Stinson, Pierre Vogler-Finck, Andrew Nesbitt, Chris Harris

Contributors

The problem

Climate crisis is here.

Solving it will require work from all parts of society.

Governance alone is unlikely to resolve the crisis.

News   Opinion   Sport   Culture   Lifestyle

World   US politics   UK   Climate crisis   Middle East   Ukraine   Environment   Science   Global development

Cop30

Rich countries have lost enthusiasm for tackling climate crisis, says Cop30 chief

Brazil's André Corrêa do Lago says countries should follow China's lead on clean energy as conference begins

- Cop30: what are the main issues?
- Net zero to NDCs: your Cop30 jargon buster

Open Work Definition

An inclusive definition for all kinds of Work.

Request Edit

This project is maintained by Open@RIT
Hosted on GitHub Pages

Open organizing, science, data, models, access, knowledge, source.

Top-down approach: funders, governmental policies.

Bottom up: individual researchers, individual projects.

OSS

- 1/3rd of all of repositories on GitHub
- 70-90% of software has open source in it (LF, 2022); 97% (Black Duck, 2025)
- Supply side worth is $4 billion; demand $9 trillion (Nagle et al.).

OSS in climate science

- No clear, predictable links
- Big Tech is disincentivized to release open models
- Government accountability is unreliable globally
- Digital Public Goods may provide some help in the future.

Open Sustain Technology

- https://opensustain.tech
- OSS-community driven project
- Started by Tobias Augspurger in 2020
- Diverse team - academics, climate scientists, OSS ecosystem workers.
- Collaborations with Linux Foundation, GitHub, and others.

Finding projects themselves is hard

- No clear internet-wide search engines for OSS
- Online marketing and AI slop causes semantic bleaching
- Polysemic terms: "cloud", "climate", "environment"
- Flood of low-quality OSS projects
- GitHub stars overinflate usage metrics
- No standardized citation format for used papers
- No standardized protocols for policy usage

List-based approach

- Prioritizes human curation
- Enables collaboration and re-use under open licensing
- Enables loose definitions of inclusion
- Uses existing systems (PRs, Markdown) in tech

Open Sustainable Technology's mission is to find, list, and share projects that preserve or analyze natural ecosystems through open technology, methods, data, intelligence, knowledge or tools.

Criteria

1. OSS license?
2. Demonstrable usage and goals that are relevant to environmental sustainability?
3. Active usage or development in the last year?
4. Use outside the project (citations, opened issues, citations or downloads)?
5. Documentation for re-use?

Add ArchPy #1311

Open | Ly0n wants to merge 1 commit into `main` from `Add-ArchPy`

💬 Conversation 0	⟿ Commits 1	✅ Checks 1	± Files changed 1

Ly0n commented yesterday

Member

[randlab/ArchPy](#)

The project is:

- ☑ Active
- ☑ Documented
- ☑ Licensed with an open source license
- ☑ Shows usage from external parties
- ☑ Directly targets environmental sustainability

Find more details in the [Contribution Guide](#).

All listed projects on [OpenSustain.tech](#) will be supported via multiple community services:

1. Issues labeled as **Good First Issue** will be visible on [ClimateTriage.com](#). This is a great way to welcome new community members to your project.
2. All new projects listed will be posted on our [Mastodon](#) and [Bluesky](#) channel.

😊

🤖 Mention @copilot in a comment to make changes to this pull request.

⟿ 🌑 Add_ArchPy

Verified ✓ 315792c
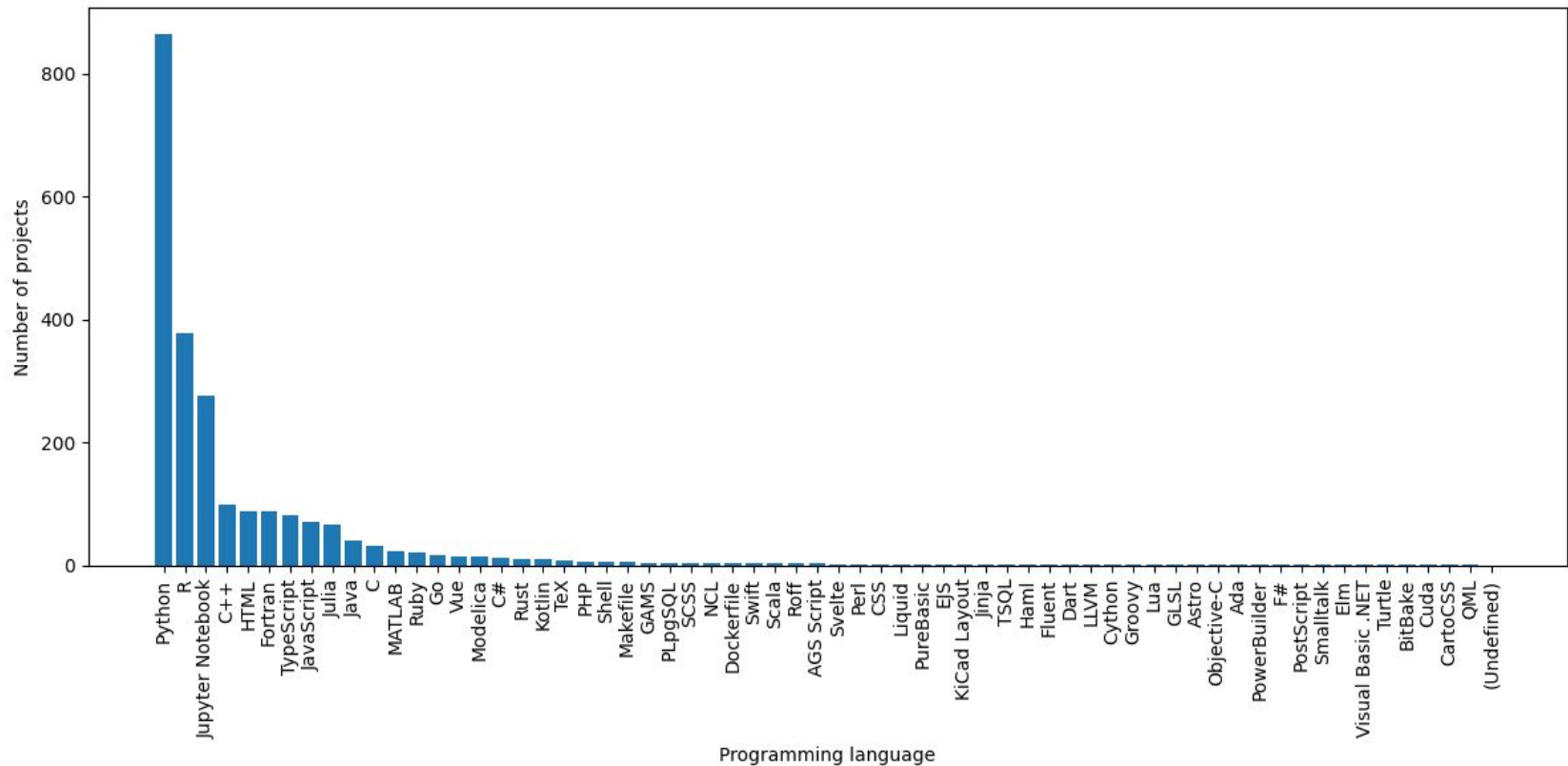
Basic statistics

- 2,497 total projects
- 2,372 on GitHub
- 70% active in the last year
- OST: 106 contributors, 84% by Tobias, 10~ other regular contributors

Programming languages

Python!

- 875 Projects
- By far the most popular language for science for the climate crisis

Python!

- **MetPy**
  A collection of tools in Python for reading, visualizing and performing calculations with weather data.
- **Xclim**
  A library of derived climate variables, i.e. climate indicators, based on xarray.
- **CodeCarbon**
  Track emissions from Compute and recommend ways to reduce their impact on the environment.
- **pandapower**
  An easy to use open source tool for power system modeling, analysis and optimization with a high degree of automation.

Python!

- **Siphon**
  A collection of Python utilities for retrieving atmospheric and oceanic data from remote sources, focusing on being able to retrieve data from Unidata data technologies.
- **Py-ART**
  A data model driven interactive toolkit for working with weather radar data.
- **cdsapi**
  Python API to access the Copernicus Climate Data Store.
- **entsoe-py**
  A Python client for the ENTSO-E API (European Network of Transmission System Operators for Electricity).

Python!

- **cfgrib**
  A Python interface to map GRIB files to the NetCDF Common Data Model following the CF Convention using ecCodes.
- **Meteostat Python**
  Access and analyze historical weather and climate data with Python.
- **pvlib-python**
  A set of documented functions for simulating the performance of photovoltaic energy systems.
- **Zarr**
  Provides an efficient, scalable, and flexible way to store and access large, multi-dimensional arrays, the core data format used in climate models and observational datasets.
- **h5netcdf**
  A Python interface for the netCDF4 file format that reads and writes local or remote HDF5 files directly via h5py or h5pyd, without relying on the Unidata netCDF library.
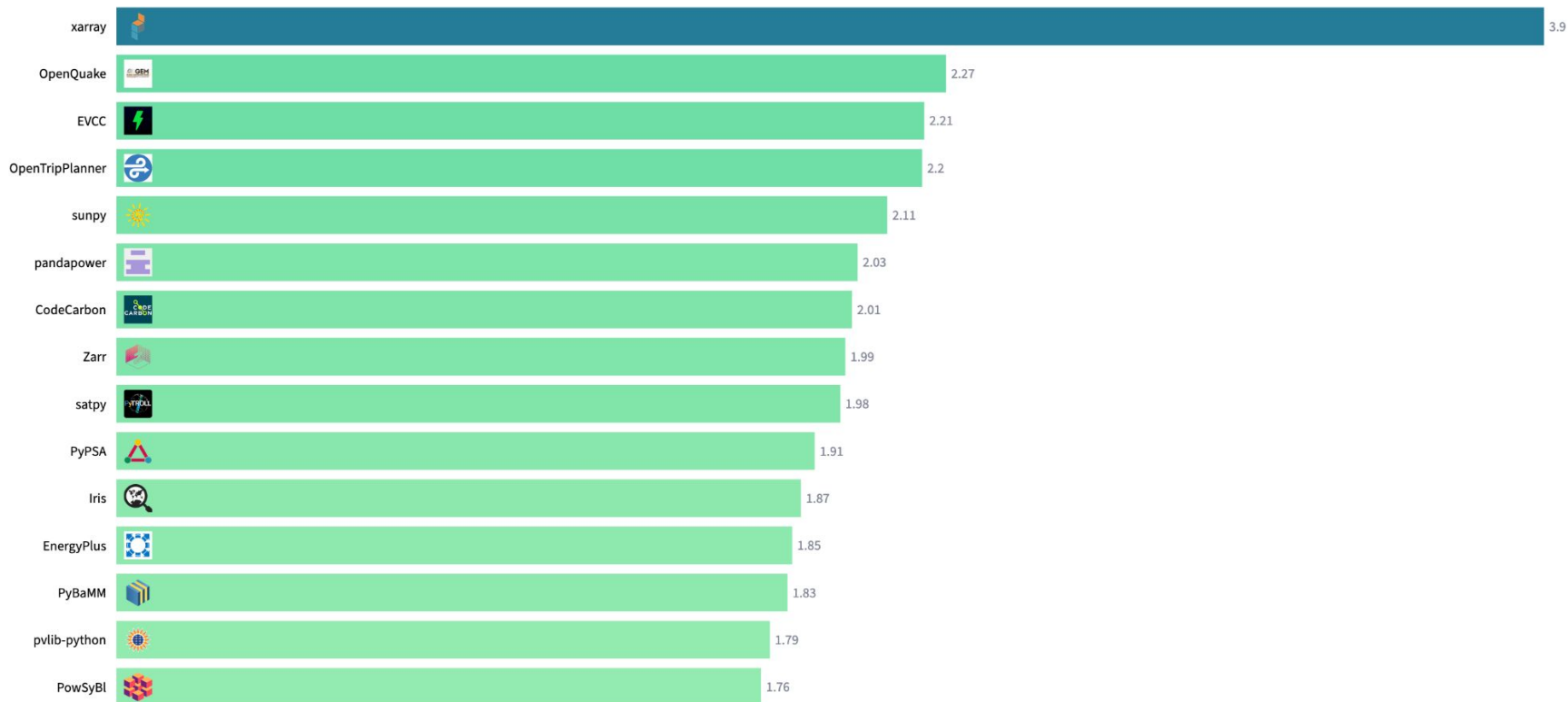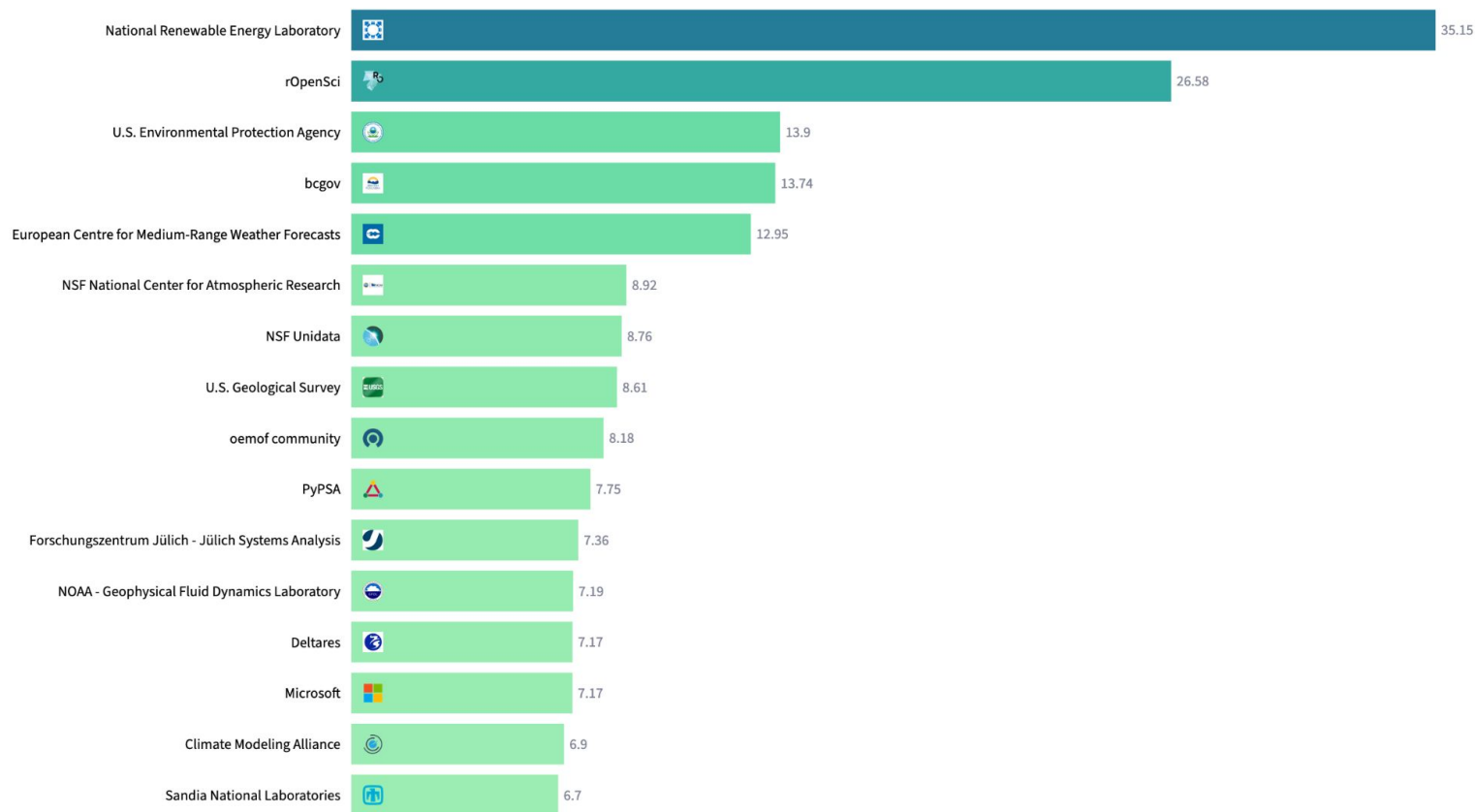
Python!

- **xarray**
  An open source project and Python package that introduces labels in the form of dimensions, coordinates, and attributes on top of raw NumPy-like arrays, which allows for more intuitive, more concise, and less error-prone user experience.

  Downloads last month: 12,132,480

All projects!

Project	Value
xarray	3.9
OpenQuake	2.27
EVCC	2.21
OpenTripPlanner	2.2
sunpy	2.11
pandapower	2.03
CodeCarbon	2.01
Zarr	1.99
satpy	1.98
PyPSA	1.91
Iris	1.87
EnergyPlus	1.85
PyBaMM	1.83
pvlib-python	1.79
PowSyBl	1.76

Who makes these?

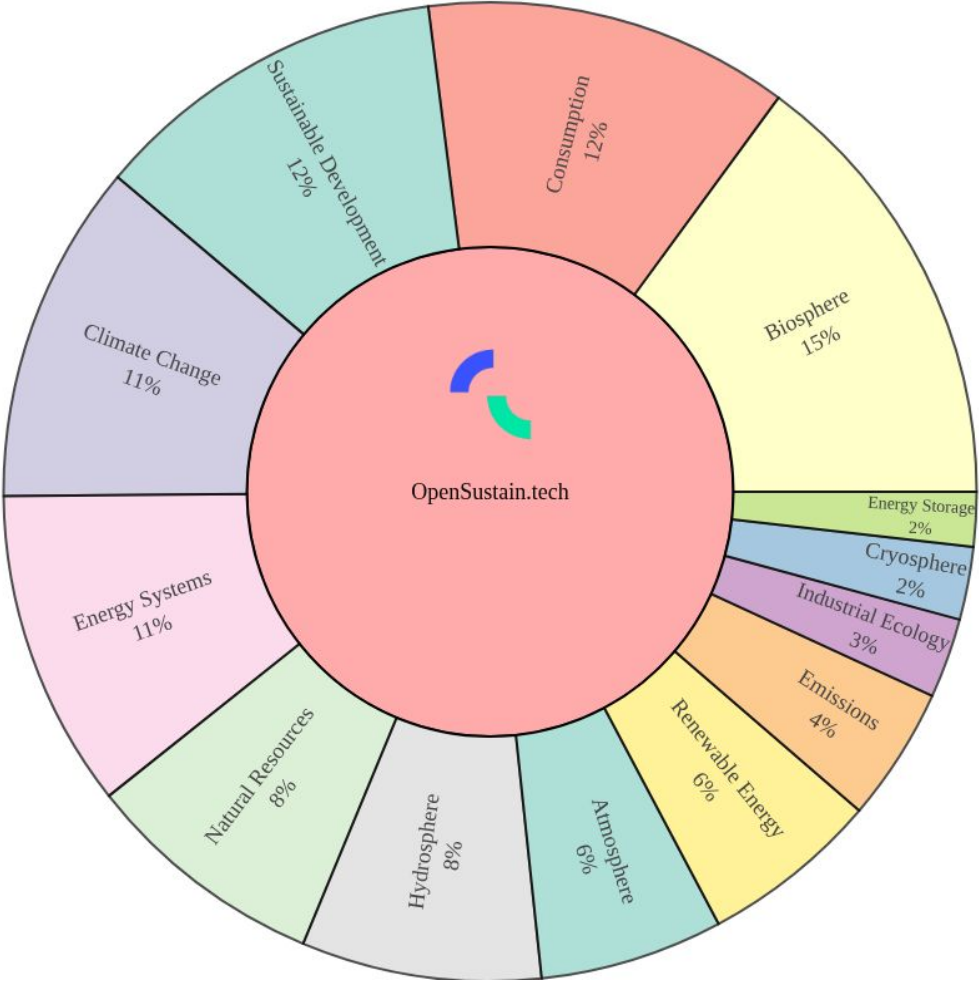| Organization	Value
National Renewable Energy Laboratory	35.15
rOpenSci	26.58
U.S. Environmental Protection Agency	13.9
bcgov	13.74
European Centre for Medium-Range Weather Forecasts	12.95
NSF National Center for Atmospheric Research	8.92
NSF Unidata	8.76
U.S. Geological Survey	8.61
oemof community	8.18
PyPSA	7.75
Forschungszentrum Jülich - Jülich Systems Analysis	7.36
NOAA - Geophysical Fluid Dynamics Laboratory	7.19
Deltares	7.17
Microsoft	7.17
Climate Modeling Alliance	6.9
Sandia National Laboratories	6.7

Number of contributors

Age distribution

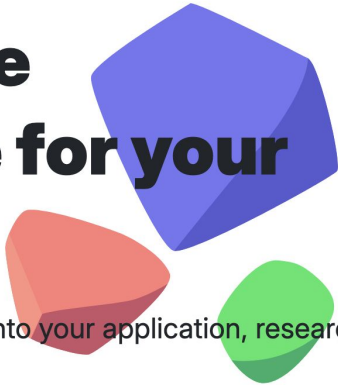Project Age Distribution (2022 vs 2025)

Categories

Dependencies

27,482 projects use OST-listed projects as deps

7,776 unique repositories; 2,715 unique packages

370 projects depend on other OST packages

52,559 dependencies; 14,518 unique packages

Open source intelligence for your project

Build open source intelligence into your application, research, or policy.

12.1 million
Packages

287 million
Repositories

24.5 billion
Dependencies

1.9 million
Maintainers

The world's most comprehensive and accurate dataset about open source production and use, **for free**

ecosyte.ms has indexed over six billion events across nearly two thousand sources to create the world's most comprehensive and accurate dataset about open source production and use.

Ecosyste.ms Science Score

Average score is 43.07 (median 39).

1,829 (72.1%) of the projects had a Zenodo.json file

1,335 (52.6%) had academic emails in their commit messages;

959 (37.8%) had DOI references

859 (33.9%) had academic publication links.

343 (13.5%) had Citation.cff files

230 (9.1%) of the projects had an institutional organizational owner

172 (6.8%) of the projects were linked to JOSS papers.

Summary

OSS is definitely in use across the climate science ecosystem.

The economic argument for OSS needs to be fleshed out.

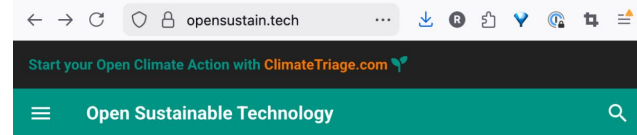Better standards for citing and linking packages are necessary.

And we need more resourcing for OpenSustain.tech itself.

Thanks

Join us at https://opensustain.tech.

http://richard.social

http://burntfen.com

Start your Open Climate Action with ClimateTriage.com

Open Sustainable Technology

Open Sustainable Technology

A directory and analysis of the open source ecosystem in the areas of climate change, sustainable energy, biodiversity and natural resources.

It is a miracle that our planet has developed a unique and stable environment for life in an otherwise indifferent and hostile cosmos. Life has taken billions of years to build up the natural resources we depend on, such as a protective atmosphere, fertile soil, stable weather, and clean drinking water. As a movement to democratize technological development and knowledge creation, open source has the potential to play a central part in preserving this stability. Open Sustainable Technology's mission is to find, list, and share projects that preserve or analyze natural ecosystems through open technology, methods, data, intelligence, knowledge or tools.
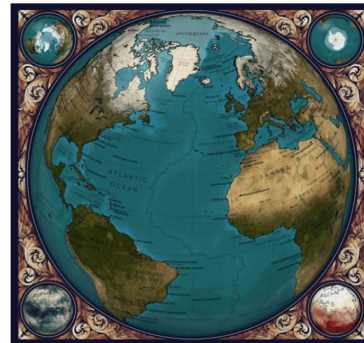
Your contribution is essential to keep this initative alive. Create a pull request to add a new project or send an email to give feedback, tips and ideas considering OpenSustain.tech. All *Good First Issue* labelled issues of the listed projects will be visible on ClimateTriage.com. All open source metadata is been provided to you by ecosyste.ms. You can find a details description of the metadata we are