Julia Kent
NSF NCAR Project Scientist / Software Engineer

Project Pythia with MyST MD

Supporting Geoscientific Python Education

NOVEMBER 5, 2025
JupyterCon, San Diego

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About Me

- From the mid-Hudson Valley in New York
- B.S. in Optics and Creative Writing from the University of Rochester
- M.S. in Atmospheric and Oceanic Sciences from University of Colorado Boulder
- Open Source Software Engineer at NCAR since 2019



I care about open source Python education because . . . I've been there AND we're solving problems that affect us all.

The Need for Open Source Scientific Python Education

Pangeo

A community for open, reproducible, scalable geoscience.



Open Source Matters, but it's not easy…



Open Science and Open Software for increased transparency, accessibility, reproducibility, and collaboration.

All these Python libraries are really great for my scientific study, but there are so many which ones to use? How am I supposed to know what's out there?

I wrote some useful scientific Python code but it isn't robust enough or I'm too embarrassed to share it with the wider community.

Help me slay Python.

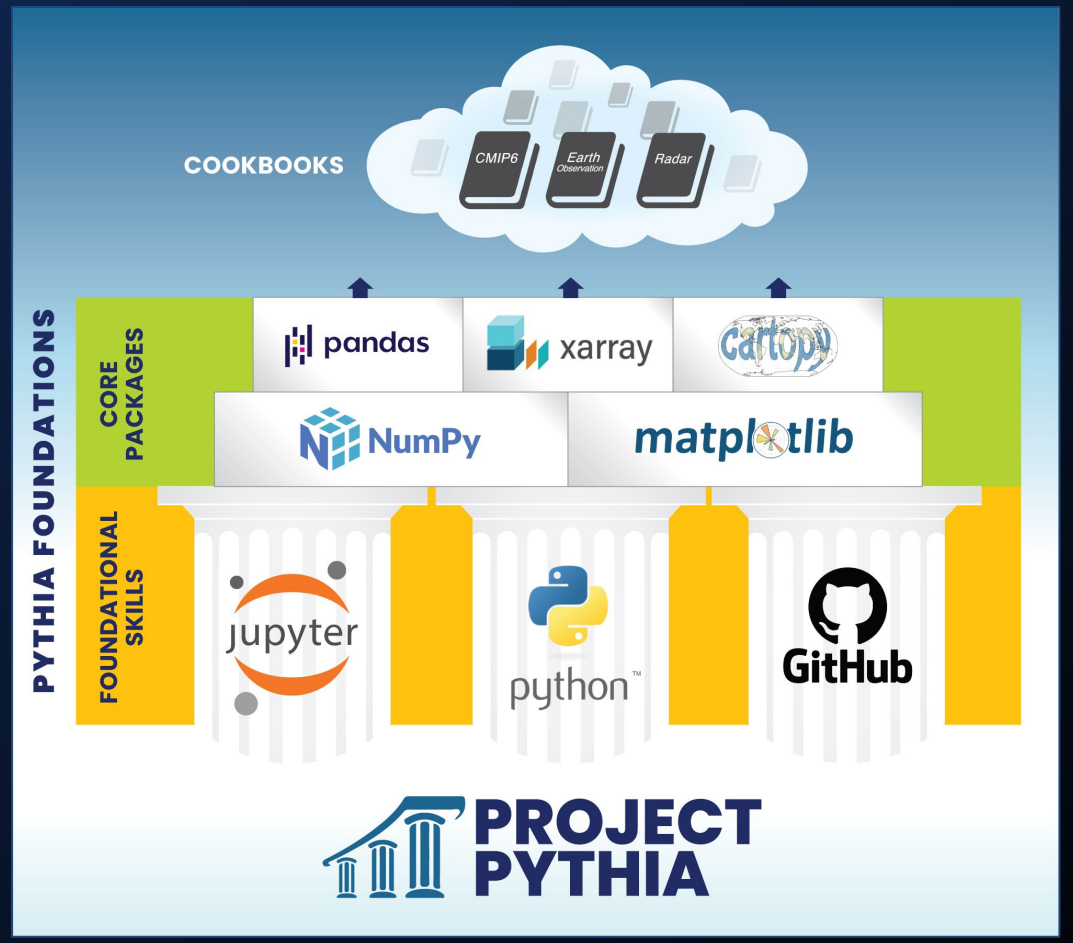
RawPixel ID : 16240367

Project Pythia: The Education Training Hub of Pangeo

Cookbooks - community contributed Jupyter Notebooks with end-to-end scientific workflows (25+)

Foundations - textbook covering Python packages and auxiliary skills

Portal - landing page



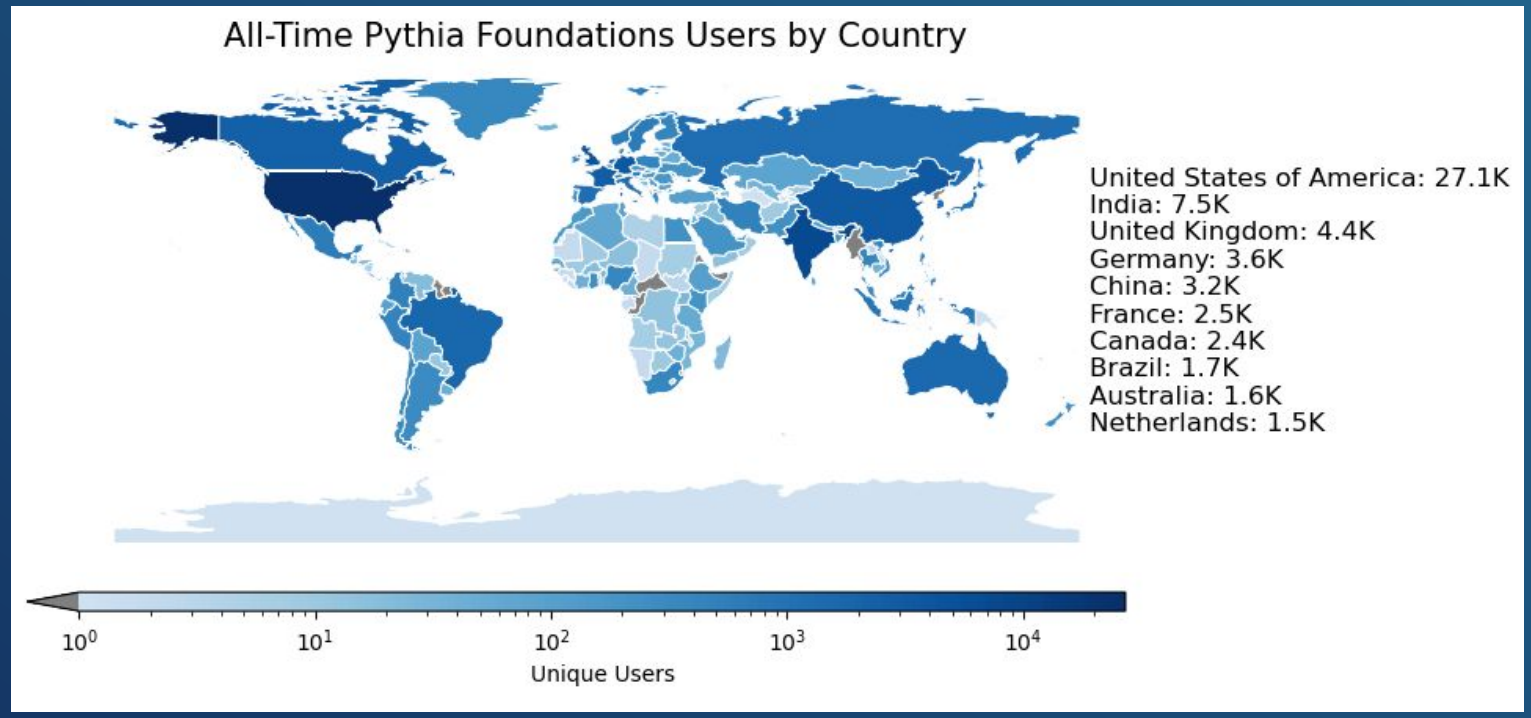
Project Pythia Cookbook Cook-Offs

Annual summer hackathons to grow our community and encourage collaborative contributions to our Cookbook gallery. 🍳

During the 2024 Cook-off, MyST team members Rowan (Curvenote) and Angus (2i2c) introduced us to MyST-MD, **beginning our MyST-transition**.



Impact: Why Our Work Matters



All-time unique users:

Portal 21.3K

Foundations 80.0K

most popular chapters on `cartopy`, the terminal, `pandas`, and `Xarray`

Cookbooks 28.1K

most popular being the “Radar Cookbook” and “Advanced Visualization Cookbook”

MyST-ification



communicatingpsychologicalscience.com/blog/can-you-really-be-hypnotized-or-is-it-all-a-facade

MySTification

- Summer 2024 Cook-off we began the transition
- June 17-18 Sprint to transition all our infrastructure from JupyterBook/Sphinx to MyST-MD to be JupyterBook 2 ready
- August 4-8 Pythia Cook-off “due date”

Our Motivation for MyST

1. Sustainability
2. Staying on the Leading Edge of Best Practices
3. Making Cookbooks Better!
4. Cross-pollination with Core Developers

1. Sustainability

Aging Infrastructure

- Bespoke Pythia-Spinx Theme silo-ed, falling out of date, and not all CSS rendering as intended
  - Default browser settings changes (light/dark mode)
  - Upstream/cascading syntax changes
  - Contributors join and leave open source projects

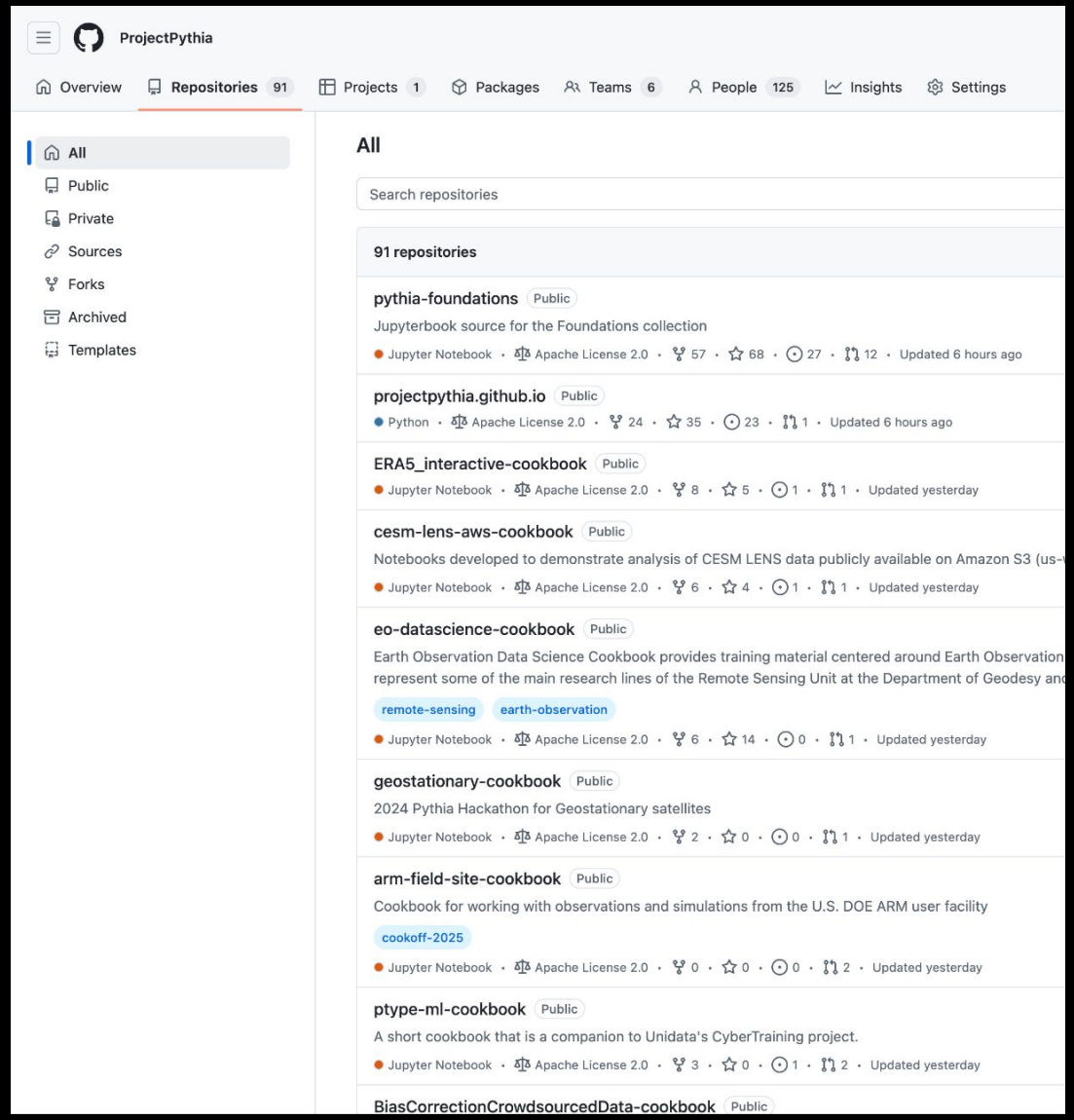
Decision: **Keep default MyST book-theme**

Repository Sprawl

- 75+ GitHub repositories in a trench coat
  - reusable GitHub actions, theme, home page, foundations book, resource gallery, cookbook gallery, one per each Cookbook
  - Updates to template repositories do not propagate changes downstream (e.g. navbar and footer links that could not be packaged with the theme)

Decision: **Leverage MyST `extends`**

The receipts



91 repositories!

The solution

pythia-config / pythia.yml ↑ Top

Code Blame Raw

```yaml
site:
  template: book-theme
  options:
    folders: true
    favicon: https://raw.githubusercontent.com/ProjectPythia/pythia-config/main/f
    logo: https://raw.githubusercontent.com/ProjectPythia/pythia-config/main/logo
    logo_dark: https://raw.githubusercontent.com/ProjectPythia/pythia-config/main
    logo_url: https://projectpythia.org
    analytics_google: G-T52X8HNYE8 # Measurement ID for Cookbooks
  nav:
    - title: Home
      url: https://projectpythia.org
    - title: Foundations
      url: https://foundations.projectpythia.org
    - title: Cookbooks
      url: https://cookbooks.projectpythia.org/
    - title: Resources
      url: https://projectpythia.org/resource-gallery/
    - title: Community
      url: https://projectpythia.org/#join-us
  actions:
    - title: Project Pythia
      url: https://projectpythia.org

  parts:
    footer: |
        :::::{grid} 3
        :class: items-center


        ```{image} https://raw.githubusercontent.com/ProjectPythia/pythia-config/
        :alt: NCAR Logo
        ```

        ```{image} https://raw.githubusercontent.com/ProjectPythia/pythia-config/
        :alt: Unidata Logo
        ```
```

myst.yml

```yaml
version: 1
extends:
  - https://raw.githubusercontent.com/projectpyth
project:
  title: Landsat ML Cookbook
  authors:
    - name: Demetris Roumis
      url: https://github.com/droumis
  github: https://github.com/projectpythia-mystmd
  copyright: '2024'
  toc:
    - file: README.md
    - title: Preamble
```

2. Best Practices

We are an open source project that teaches open source coding, so we want to be aware of changes in our open source ecosystem!

Not only our site content, but our site infrastructure itself serves as a useful model for the broader community.

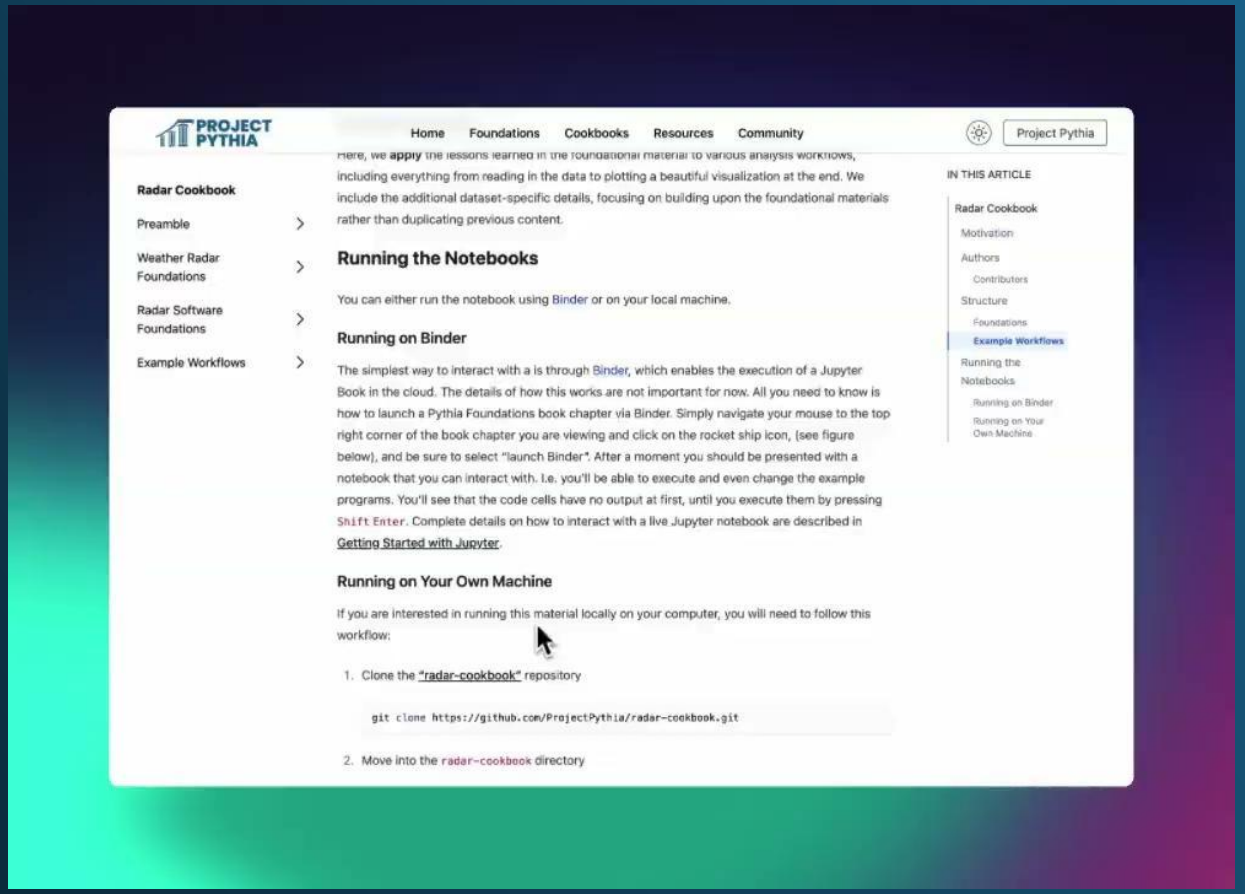


givainc.com/blog/guide-knowledge-management-best-practices-tools-km-features/

3. Making Cookbooks Better

New functionality suits our needs and the needs of our users!

- Cross-referencing
- Embedding content
- Automated bibliographies
- Overall easier contribution pipeline



4. Working with Core Developers

There is value in being an early adopter

- Can provide feedback on alpha functionality and use cases


The Big Reveal
Before and After
ebay.com/itm/233231212471

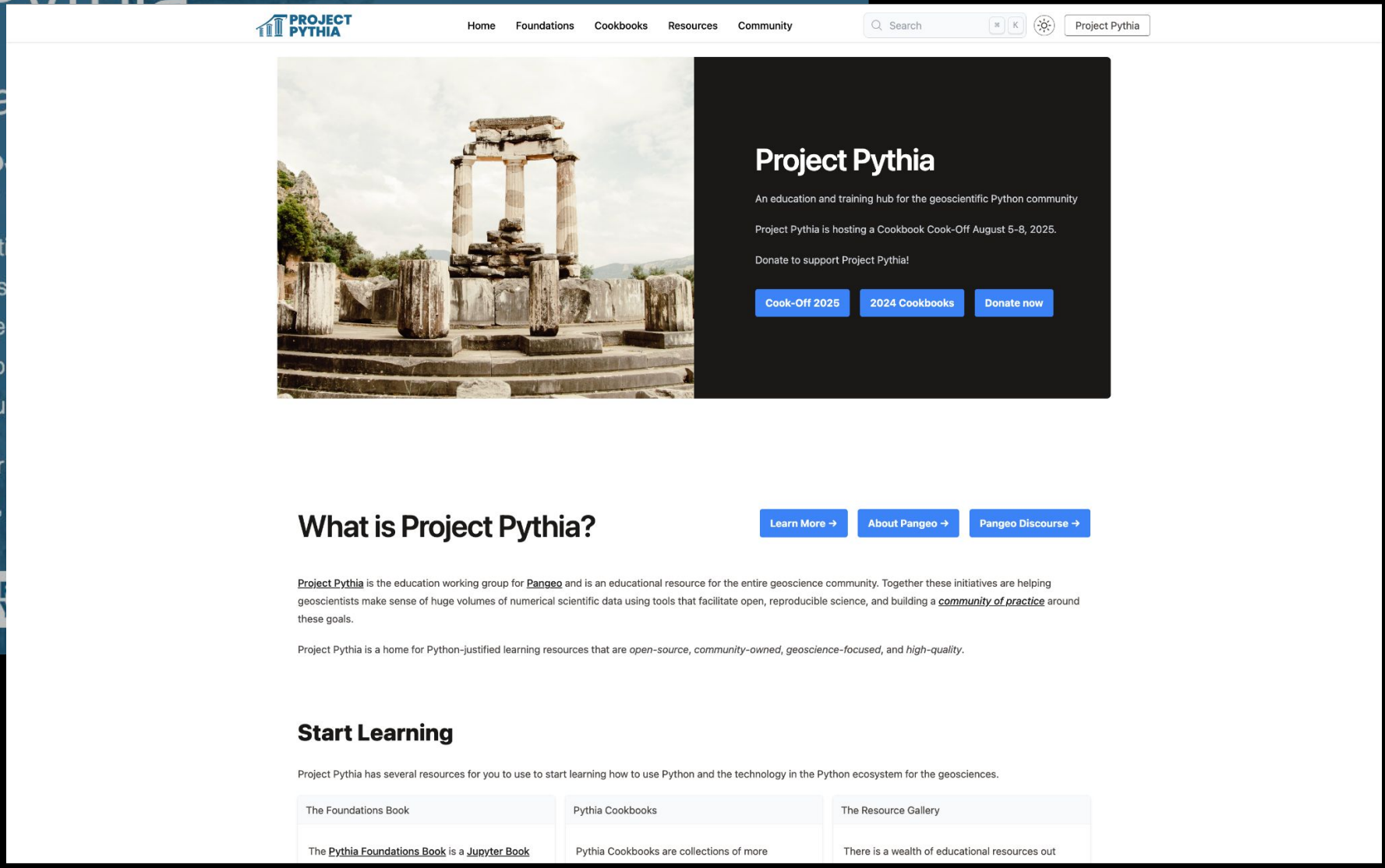

PROJECT PYTHIA
Home
Foundations
Cookbooks
Resources
Community
Project Pythia
An education and training hub for the geoscientific Python community
Project Pythia is the education working group for Pangeo and is an educational resource for the entire geoscience community. Together these initiatives are helping geoscientists make sense of huge volumes of numerical scientific data using tools that facilitate open, reproducible science, and building an inclusive community of practice around these goals.
Project Pythia is a home for Python-centered learning resources that are open-source, community-owned, geoscience-focused, and high-quality.
About PROJECT PYTHIA
About PANGEO

BEFORE

BEFORE



AFTER



PROJECT PYTHIA Home Foundations Cookbooks Resources Community Blog

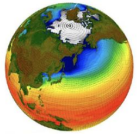
Cookbooks Gallery

Pythia Cookbooks provide example workflows on more advanced and domain-specific problems developed by the Pythia community. Cookbooks build on top of skills you learn in Pythia Foundations.

Cookbooks are created from Jupyter Notebooks that we strive to binderize so each Cookbook can be executed in the cloud with a single click from your browser, but in some instances executing a Cookbook will require running the notebooks locally.

Interested in contributing a new Cookbook or contributing to an existing Cookbook? Great! Please see the Project Pythia Cookbook Contributor's Guide, and consider opening a discussion under the Project Pythia category of the Pangeo Discourse.

Submit a new Cookbook Clear all filters Domains Packages



CESM LENS on AWS Cookbook

Author: Banihirwe, Anderson, Bonnlander, Brian, de La Beaujardière, Jeff, Henderson, Scott, CESM LENS on AWS Cookbook contributors

Notebooks developed to demonstrate analysis of CESM LENS data publicly available on Amazon S3 (us-west-2 region) using Xarray and Dask.

climate dask intake-esm xarray

nightly-build passing launch binder DOI 10.5281/zenodo.8088114



CMIP6 Cookbook

Author: Abernathey, Ryan, Drake, Henri, Ford, Robert R., CMIP6 Cookbook contributors

Examples of analysis of Google Cloud CMIP6 data using Pangeo tools.

climate intake-esm xesmf

nightly-build failing launch binder DOI 10.5281/zenodo.8075799



HRRR AWS Cookbook

Author: Tyle, Kevin, HRRR-AWS Cookbook contributors

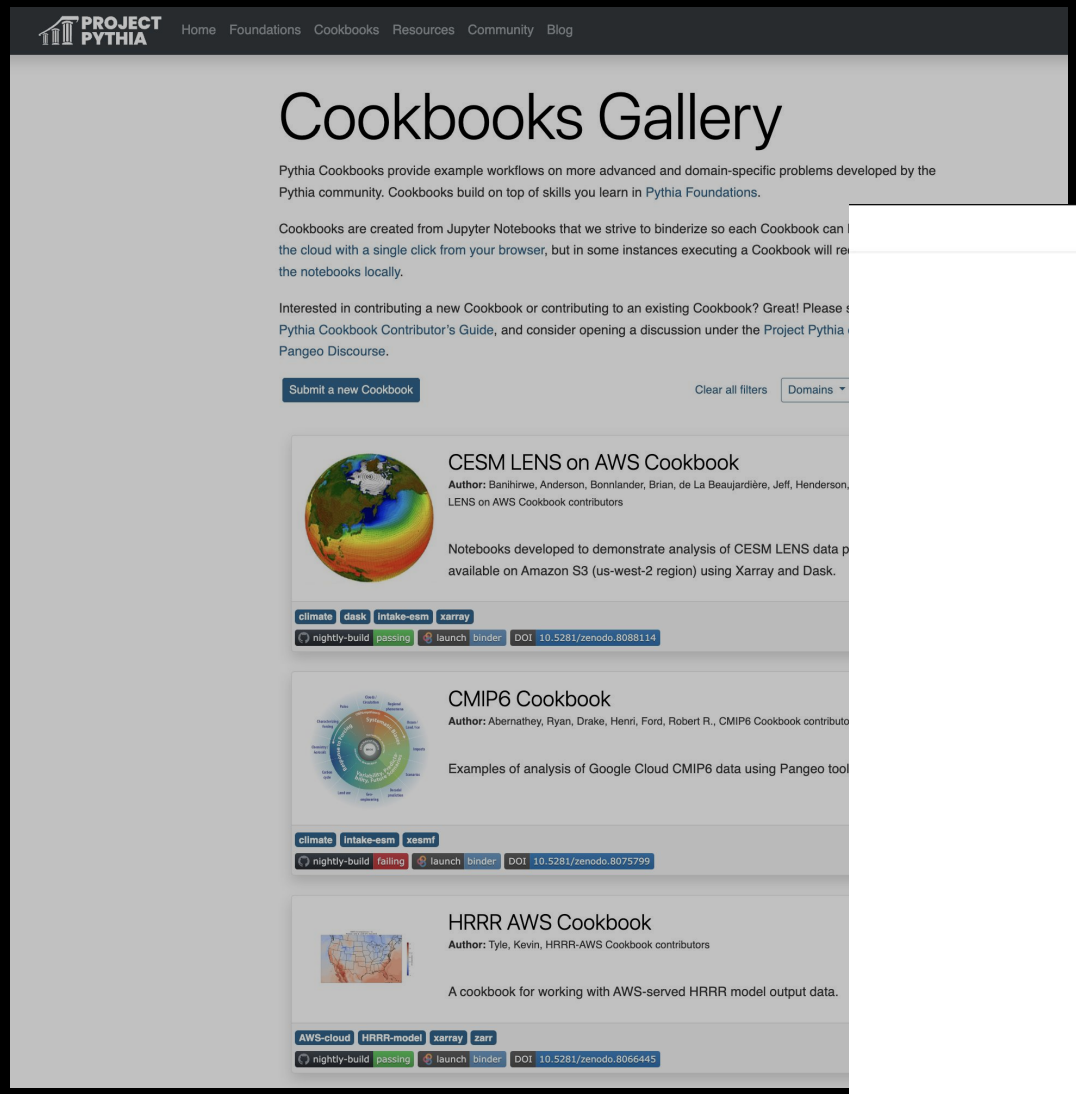
A cookbook for working with AWS-served HRRR model output data.

AWS-cloud HRRR-model xarray zarr

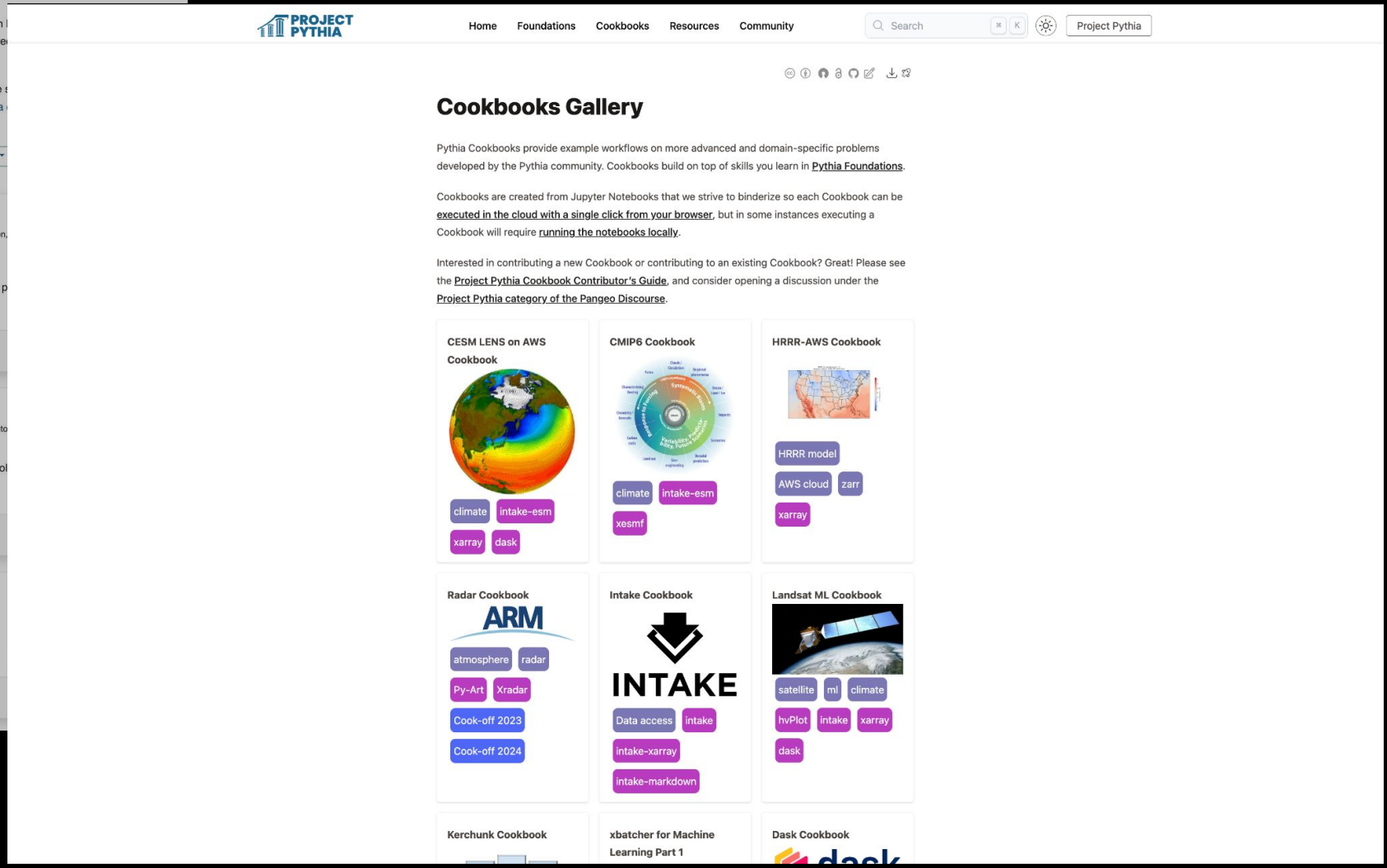
nightly-build passing launch binder DOI 10.5281/zenodo.8066445

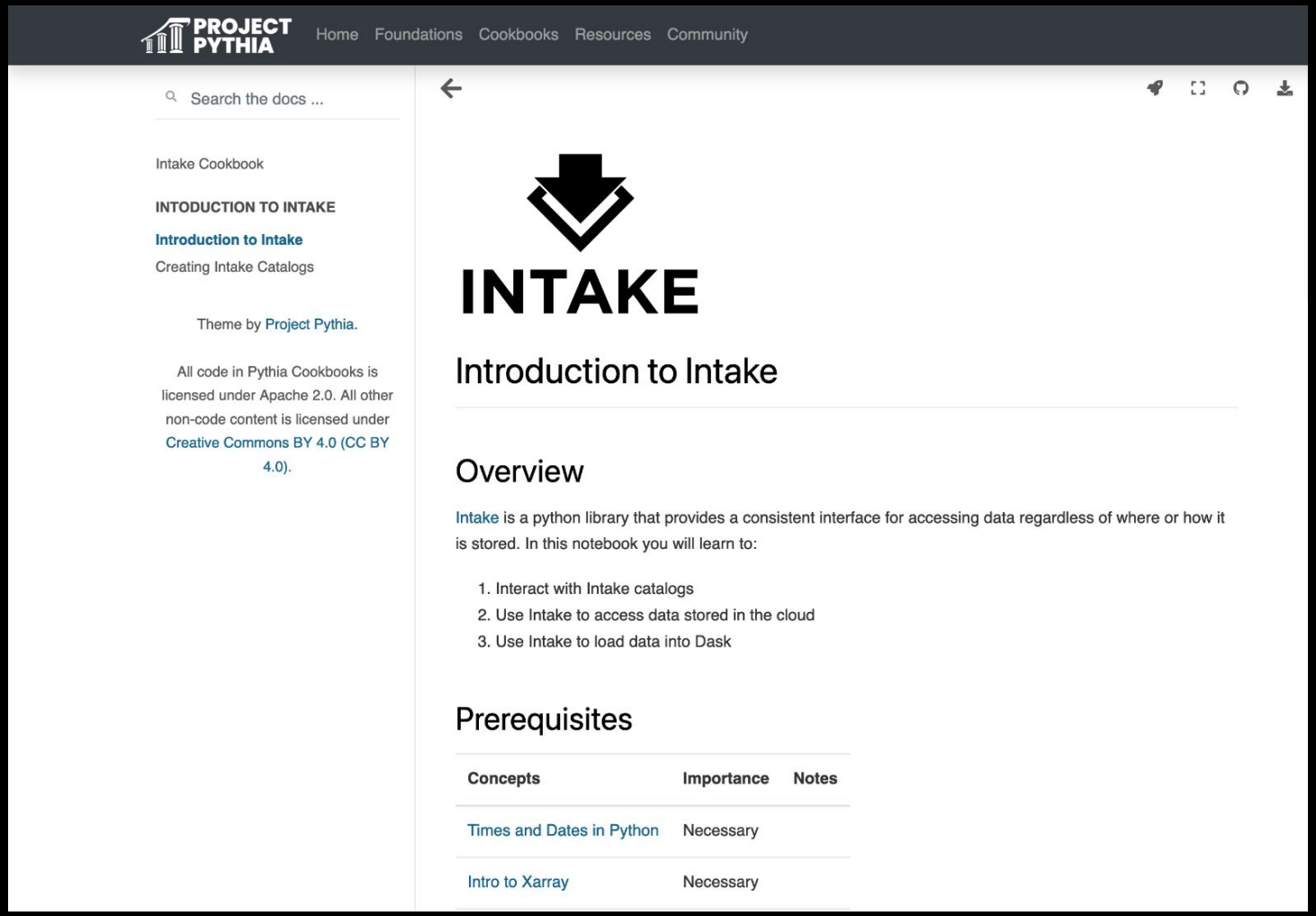
BEFORE

BEFORE

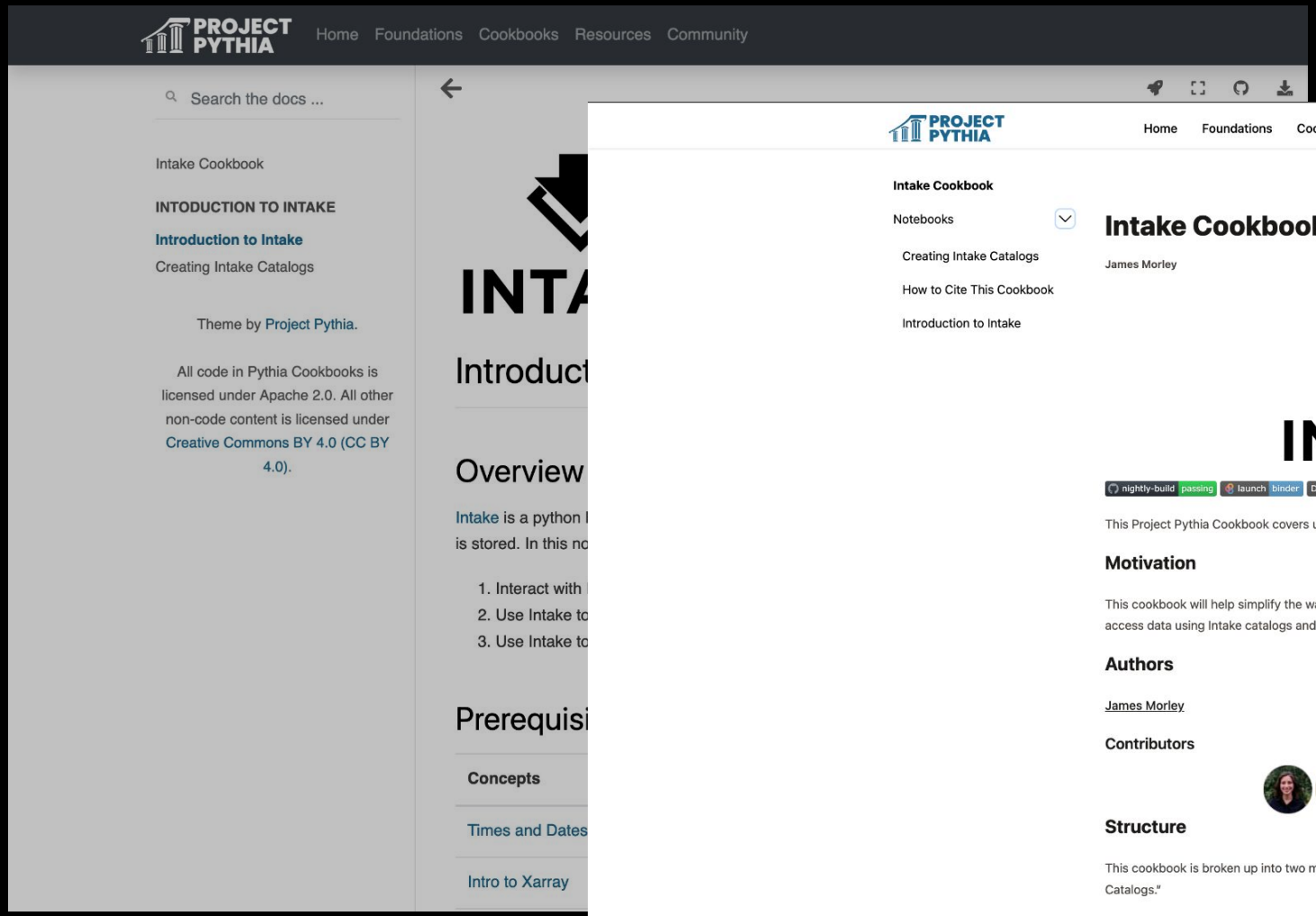


AFTER



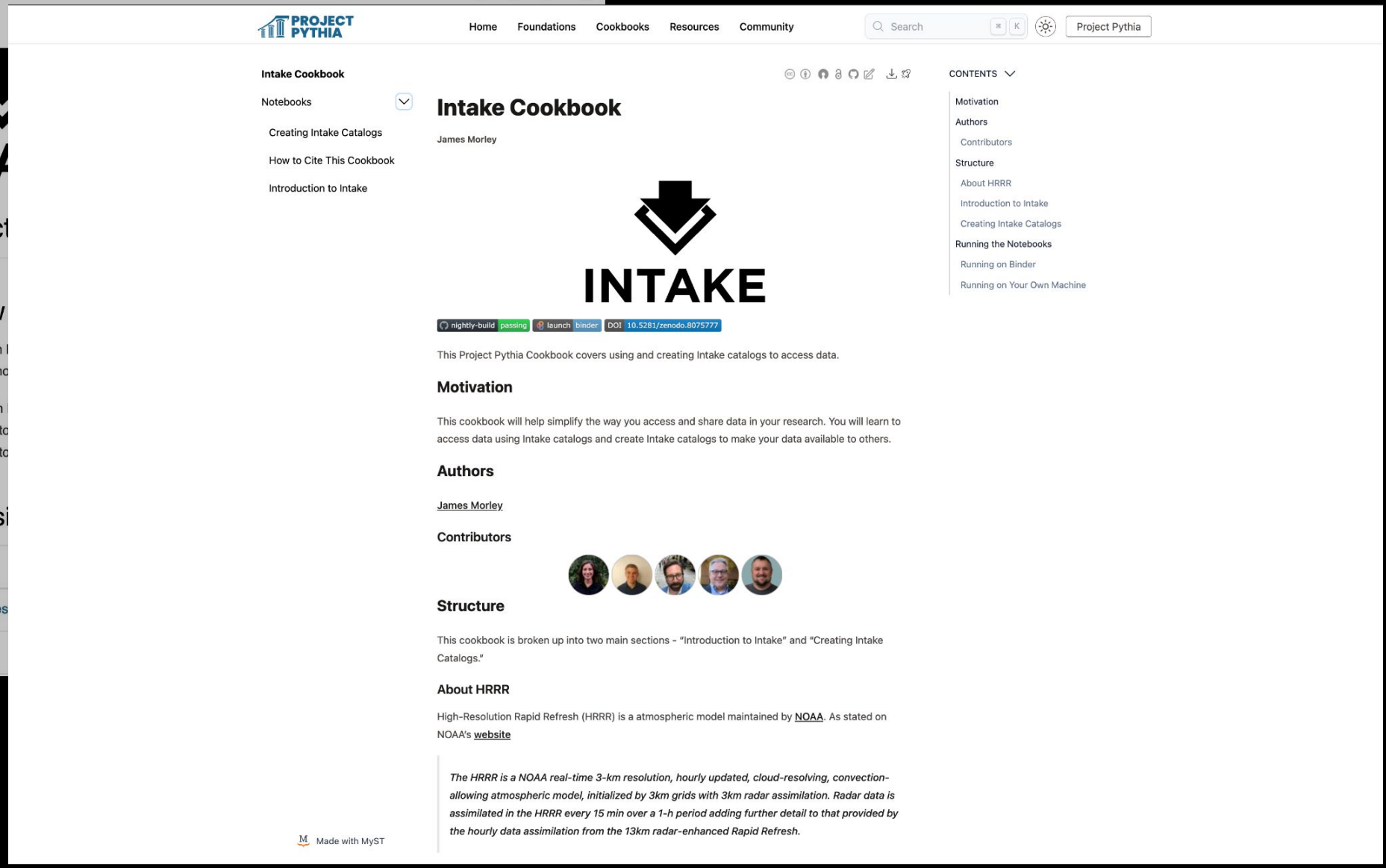

PROJECT PYTHIA
Home
Foundations
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Community
Search the docs ...
Intake Cookbook
INTODUCTION TO INTAKE
Introduction to Intake
Creating Intake Catalogs
Theme by Project Pythia.
All code in Pythia Cookbooks is licensed under Apache 2.0. All other non-code content is licensed under Creative Commons BY 4.0 (CC BY 4.0).
INTAKE
Introduction to Intake
Overview
Intake is a python library that provides a consistent interface for accessing data regardless of where or how it is stored. In this notebook you will learn to:
1. Interact with Intake catalogs
2. Use Intake to access data stored in the cloud
3. Use Intake to load data into Dask
Prerequisites
Concepts
Importance
Notes
Times and Dates in Python
Necessary
Intro to Xarray
Necessary

BEFORE



BEFORE

AFTER



Getting to “YES”

It takes a lot of work now to invest in an easier future.

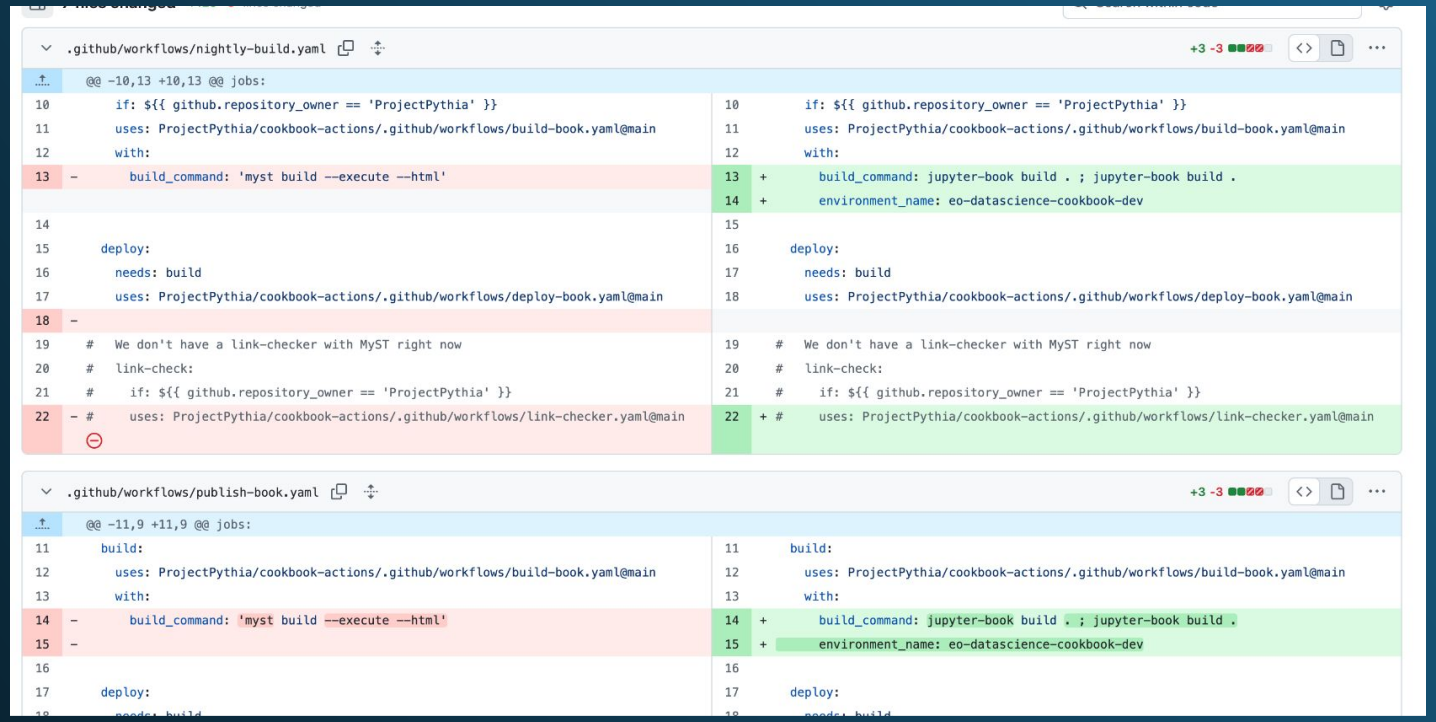
Stood up a sandbox **ProjectPythia-mystmd** GitHub organization to host exploratory MyST versions of our sites.

Decided to flip the switch with a goal of finishing the transition before the **August 2025 Cookbook Cook-off Hackathon**

- more stability for contributors
- fewer repositories to transition later
- decided to transition current in-progress Cookbooks as well

Updating Collaborative Workflows

1. Adapt our GitHub Actions workflows (build, preview, deploy)
   a. Update default build command
   b. Add logic to handle MyST's `BASE_URL` requirement
2. Update calls to trigger these workflows



.github/workflows/nightly-build.yaml +3 -3

```
@@ -10,13 +10,13 @@ jobs:
      if: ${{ github.repository_owner == 'ProjectPythia' }}
      uses: ProjectPythia/cookbook-actions/.github/workflows/build-book.yaml@main
      with:
-       build_command: 'myst build --execute --html'
+       build_command: jupyter-book build . ; jupyter-book build .
+       environment_name: eo-datascience-cookbook-dev

  deploy:
    needs: build
    uses: ProjectPythia/cookbook-actions/.github/workflows/deploy-book.yaml@main
-
  #  We don't have a link-checker with MyST right now
  #  link-check:
  #    if: ${{ github.repository_owner == 'ProjectPythia' }}
-#    uses: ProjectPythia/cookbook-actions/.github/workflows/link-checker.yaml@main
+#    uses: ProjectPythia/cookbook-actions/.github/workflows/link-checker.yaml@main
```

.github/workflows/publish-book.yaml +3 -3

```
@@ -11,9 +11,9 @@ jobs:
    uses: ProjectPythia/cookbook-actions/.github/workflows/build-book.yaml@main
    with:
-     build_command: 'myst build --execute --html'
+     build_command: jupyter-book build . ; jupyter-book build .
+     environment_name: eo-datascience-cookbook-dev

  deploy:
```

How to Migrate (Cookbook edition)

Files that needed addition:

1. `myst.yml`

Files that needed deletion:

2. `.isort.cfg`
3. `_config.yml`
4. `_toc.yml`
5. `_static/custom.css`
6. `_static/footer-logo-nsf.png`
7. `_templates/footer-extra.html`
8. `.github/workflows/trigger-delete-preview.yaml`

Files that needed modification:

9. `.github/workflows/nightly-build.yaml`
10. `.github/workflows/publish-book.yaml`
11. `.github/workflows/trigger-book-build.yaml`
12. `.github/workflows/trigger-delete-preview.yaml`
13. `README.md`
14. `.gitignore`
15. `environment.yml`

and any file with a link to Pythia content ending in `.html`

\+ miscellaneous files that weren't rendering as expected

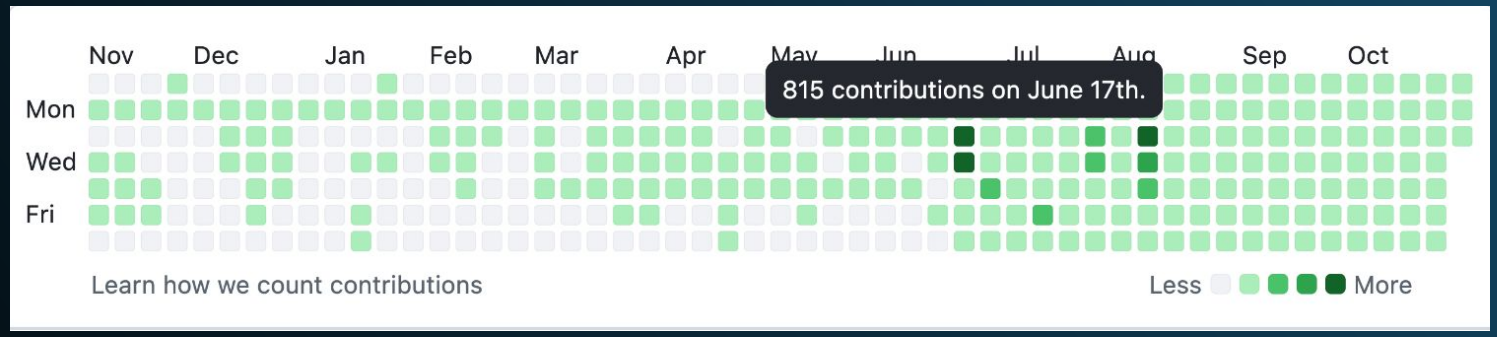
multiply by 70+ Cookbooks

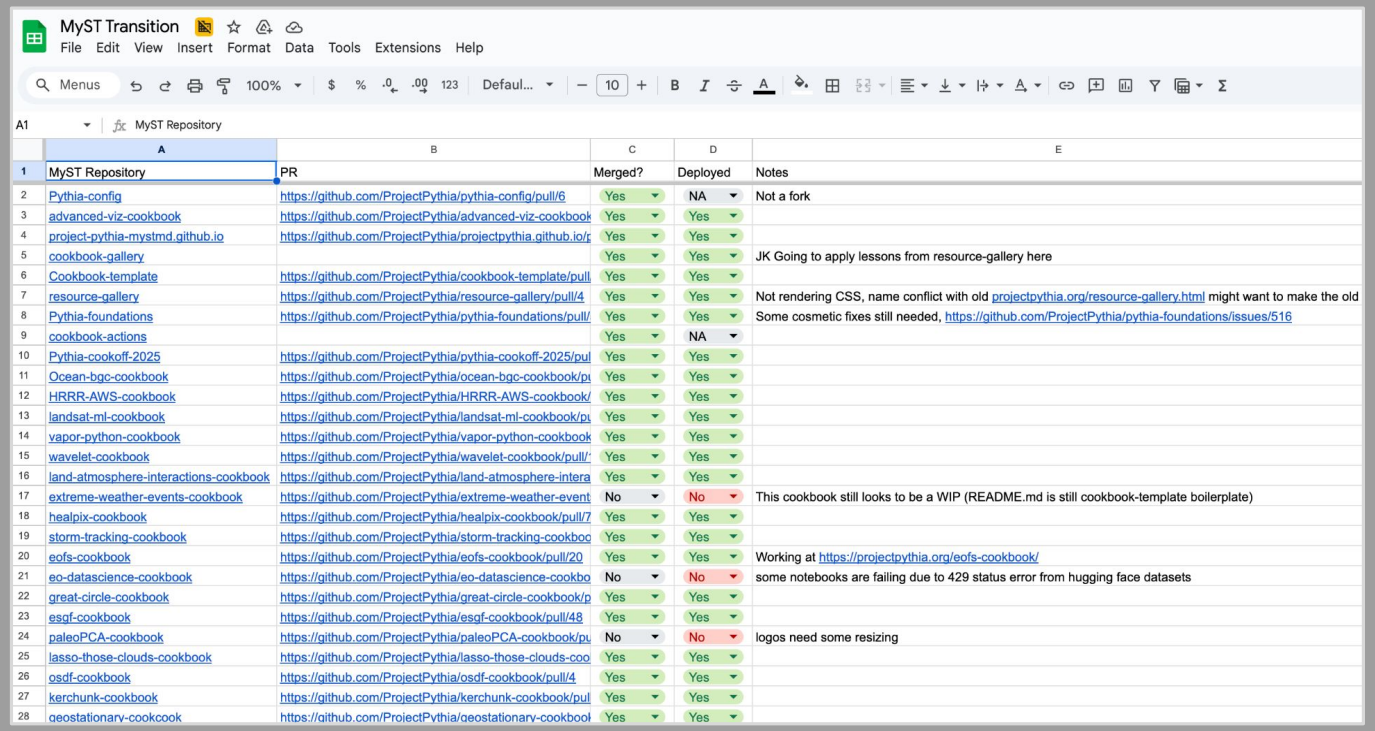
June 17-18

Hack days to tinker, to test, to review PRs, and to deploy the new MySTified sites

Previously MySTified Cookbooks needed touch up:

- Links pointed to old GitHub Org paths
- Action updates needed to be incorporated
- Remove all stale code

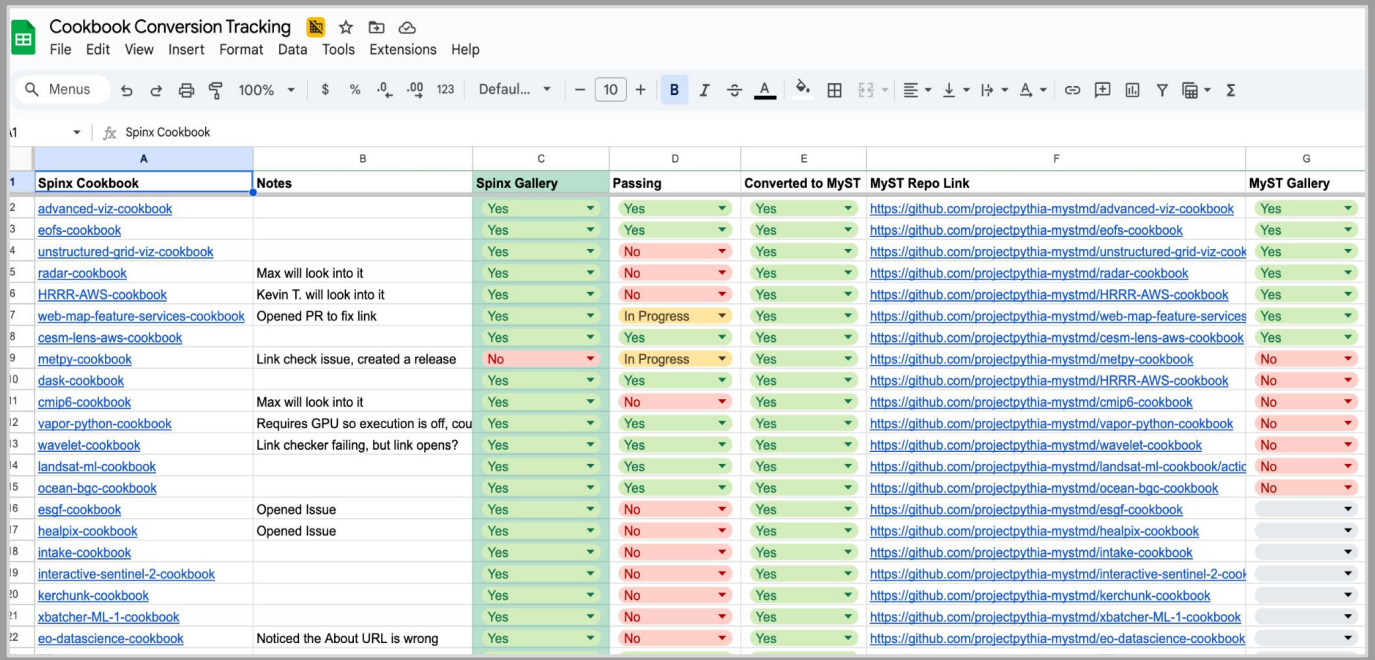




MyST Transition

File Edit View Insert Format Data Tools Extensions Help

MyST Repository	PR	Merged?	Deployed	Notes
Pythia-config	https://github.com/ProjectPythia/pythia-config/pull/6	Yes	NA	Not a fork
advanced-viz-cookbook	https://github.com/ProjectPythia/advanced-viz-cookbook	Yes	Yes	
project-pythia-mystmd.github.io	https://github.com/ProjectPythia/projectpythia.github.io/p	Yes	Yes	
cookbook-gallery		Yes	Yes	JK Going to apply lessons from resource-gallery here
Cookbook-template	https://github.com/ProjectPythia/cookbook-template/pull	Yes	Yes	
resource-gallery	https://github.com/ProjectPythia/resource-gallery/pull/4	Yes	Yes	Not rendering CSS, name conflict with old projectpythia.org/resource-gallery.html might want to make the old
Pythia-foundations	https://github.com/ProjectPythia/pythia-foundations/pull/	Yes	Yes	Some cosmetic fixes still needed, https://github.com/ProjectPythia/pythia-foundations/issues/516
cookbook-actions		Yes	NA	
Pythia-cookoff-2025	https://github.com/ProjectPythia/pythia-cookoff-2025/pul	Yes	Yes	
Ocean-bgc-cookbook	https://github.com/ProjectPythia/ocean-bgc-cookbook/pu	Yes	Yes	
HRRR-AWS-cookbook	https://github.com/ProjectPythia/HRRR-AWS-cookbook/	Yes	Yes	
landsat-ml-cookbook	https://github.com/ProjectPythia/landsat-ml-cookbook/pu	Yes	Yes	
vapor-python-cookbook	https://github.com/ProjectPythia/vapor-python-cookbook	Yes	Yes	
wavelet-cookbook	https://github.com/ProjectPythia/wavelet-cookbook/pull/	Yes	Yes	
land-atmosphere-interactions-cookbook	https://github.com/ProjectPythia/land-atmosphere-intera	Yes	Yes	
extreme-weather-events-cookbook	https://github.com/ProjectPythia/extreme-weather-event	No	No	This cookbook still looks to be a WIP (README.md is still cookbook-template boilerplate)
healpix-cookbook	https://github.com/ProjectPythia/healpix-cookbook/pull/7	Yes	Yes	
storm-tracking-cookbook	https://github.com/ProjectPythia/storm-tracking-cookboo	Yes	Yes	
eofs-cookbook	https://github.com/ProjectPythia/eofs-cookbook/pull/20	Yes	Yes	Working at https://projectpythia.org/eofs-cookbook/
eo-datascience-cookbook	https://github.com/ProjectPythia/eo-datascience-cookbo	No	No	some notebooks are failing due to 429 status error from hugging face datasets
great-circle-cookbook	https://github.com/ProjectPythia/great-circle-cookbook/p	Yes	Yes	
esgf-cookbook	https://github.com/ProjectPythia/esgf-cookbook/pull/48	Yes	Yes	
paleoPCA-cookbook	https://github.com/ProjectPythia/paleoPCA-cookbook/pu	No	No	logos need some resizing
lasso-those-clouds-cookbook	https://github.com/ProjectPythia/lasso-those-clouds-coo	Yes	Yes	
osdf-cookbook	https://github.com/ProjectPythia/osdf-cookbook/pull/4	Yes	Yes	
kerchunk-cookbook	https://github.com/ProjectPythia/kerchunk-cookbook/pul	Yes	Yes	
geostationary-cookcook	https://github.com/ProjectPythia/geostationary-cookbool	Yes	Yes	



Cookbook Conversion Tracking

File Edit View Insert Format Data Tools Extensions Help

Spinx Cookbook	Notes	Spinx Gallery	Passing	Converted to MyST	MyST Repo Link	MyST Gallery
advanced-viz-cookbook		Yes	Yes	Yes	https://github.com/projectpythia-mystmd/advanced-viz-cookbook	Yes
eofs-cookbook		Yes	Yes	Yes	https://github.com/projectpythia-mystmd/eofs-cookbook	Yes
unstructured-grid-viz-cookbook		Yes	No	Yes	https://github.com/projectpythia-mystmd/unstructured-grid-viz-cook	Yes
radar-cookbook	Max will look into it	Yes	No	Yes	https://github.com/projectpythia-mystmd/radar-cookbook	Yes
HRRR-AWS-cookbook	Kevin T. will look into it	Yes	No	Yes	https://github.com/projectpythia-mystmd/HRRR-AWS-cookbook	Yes
web-map-feature-services-cookbook	Opened PR to fix link	Yes	In Progress	Yes	https://github.com/projectpythia-mystmd/web-map-feature-services	Yes
cesm-lens-aws-cookbook		Yes	Yes	Yes	https://github.com/projectpythia-mystmd/cesm-lens-aws-cookbook	Yes
metpy-cookbook	Link check issue, created a release	No	In Progress	Yes	https://github.com/projectpythia-mystmd/metpy-cookbook	No
dask-cookbook		Yes	Yes	Yes	https://github.com/projectpythia-mystmd/HRRR-AWS-cookbook	No
cmip6-cookbook	Max will look into it	Yes	No	Yes	https://github.com/projectpythia-mystmd/cmip6-cookbook	No
vapor-python-cookbook	Requires GPU so execution is off, cou	Yes	Yes	Yes	https://github.com/projectpythia-mystmd/vapor-python-cookbook	No
wavelet-cookbook	Link checker failing, but link opens?	Yes	Yes	Yes	https://github.com/projectpythia-mystmd/wavelet-cookbook	No
landsat-ml-cookbook		Yes	Yes	Yes	https://github.com/projectpythia-mystmd/landsat-ml-cookbook/actic	No
ocean-bgc-cookbook		Yes	Yes	Yes	https://github.com/projectpythia-mystmd/ocean-bgc-cookbook	No
esgf-cookbook	Opened Issue	Yes	No	Yes	https://github.com/projectpythia-mystmd/esgf-cookbook	
healpix-cookbook	Opened Issue	Yes	No	Yes	https://github.com/projectpythia-mystmd/healpix-cookbook	
intake-cookbook		Yes	No	Yes	https://github.com/projectpythia-mystmd/intake-cookbook	
interactive-sentinel-2-cookbook		Yes	No	Yes	https://github.com/projectpythia-mystmd/interactive-sentinel-2-cook	
kerchunk-cookbook		Yes	No	Yes	https://github.com/projectpythia-mystmd/kerchunk-cookbook	
xbatcher-ML-1-cookbook		Yes	No	Yes	https://github.com/projectpythia-mystmd/xbatcher-ML-1-cookbook	
eo-datascience-cookbook	Noticed the About URL is wrong	Yes	No	Yes	https://github.com/projectpythia-mystmd/eo-datascience-cookbook	

Preliminary conversion in sandbox ProjectPythia-mystmd GitHub Organization

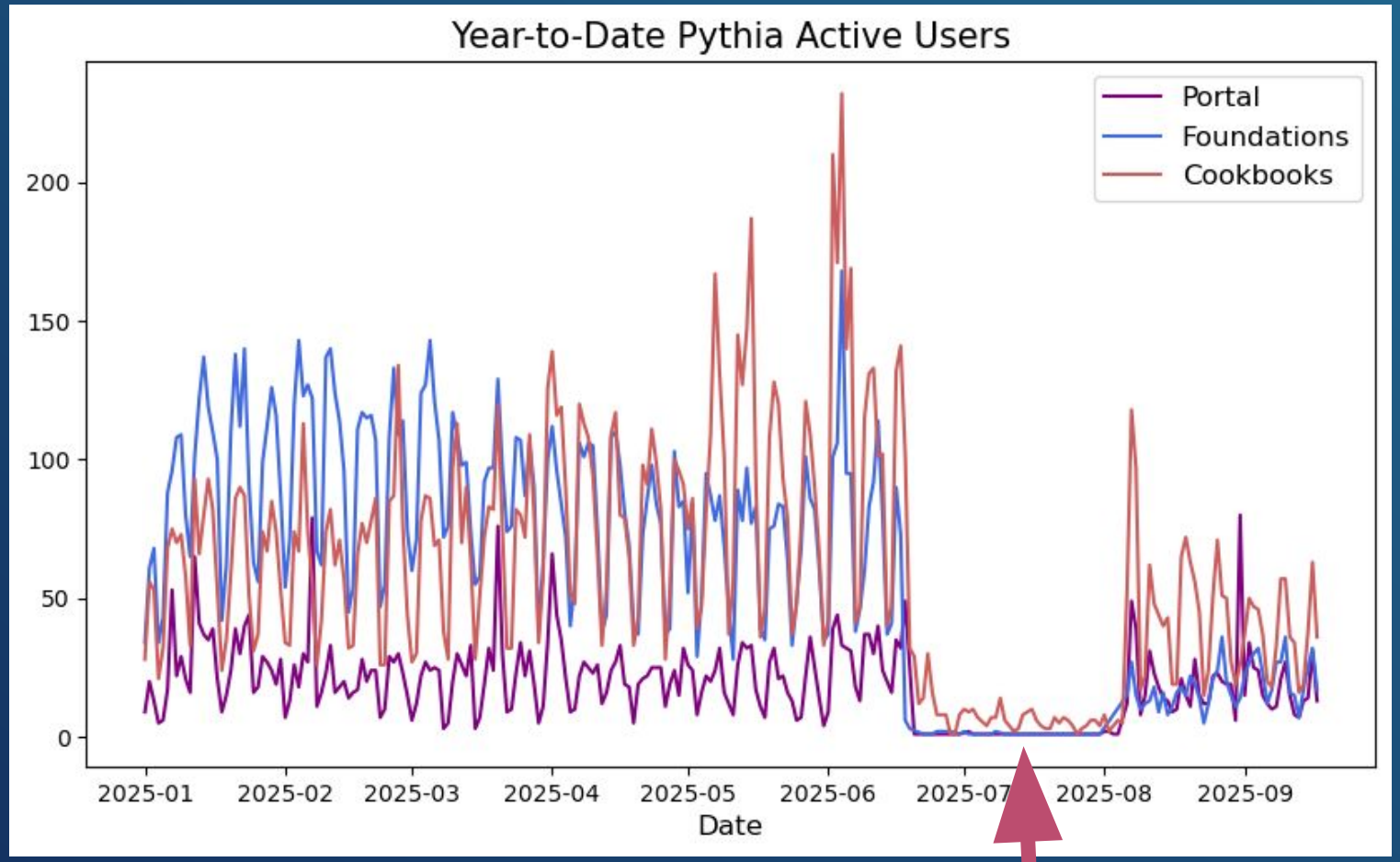
Pulling MyST-ified Cookbooks into the Project Pythia GitHub Organization



We could not have completed the process so quickly without the rapid response from the upstream MyST Markdown team.

stock.adobe.com/images/vibrant-blue-confetti-bursting-through-the-frame/1450363015

The Last Push



Oops - No Metrics

Before the Cook-off, there were still some things to clean up:

- Fix automated metrics
- Update Contribution Guides
- Fix broken links

2025 Pythia Cookbook Cook-off Retrospective

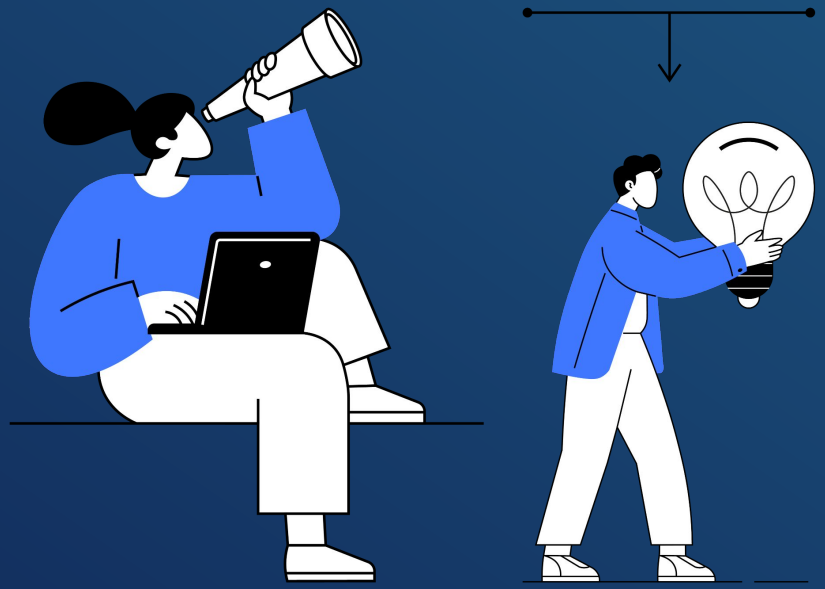


4 days
12 breakout groups
68 registrants

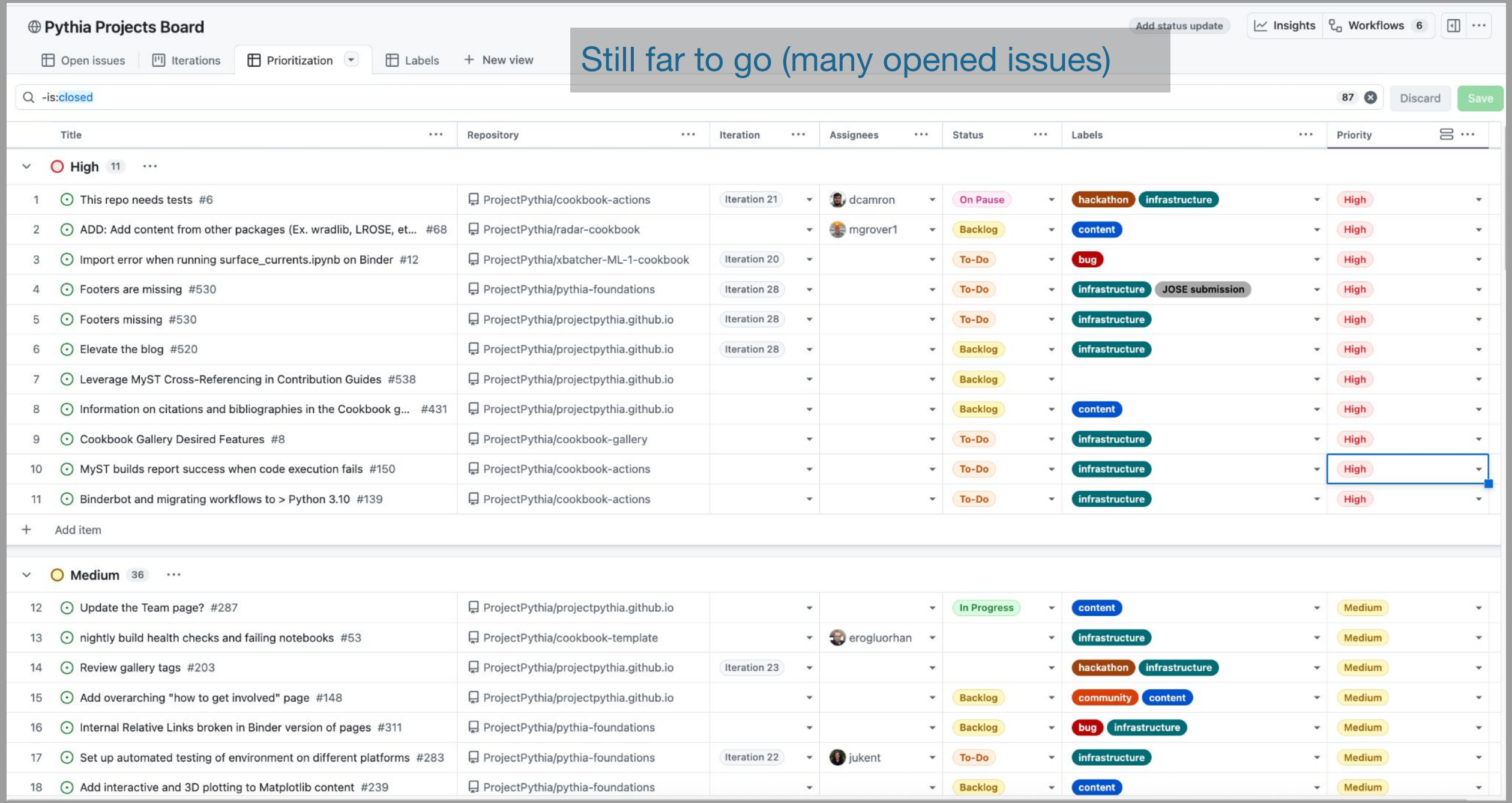
> "Project Pythia's work on MyST infrastructure makes open science quick and easy: instant, reproducible JupyterBook environments powered by fast builds and seamless JupyterHub integration. It's turned our open radar and ARM summer schools into true hands-on, zero-set up learning experiences, significantly reducing the time to science."
>
> - Max Grover, Spire Global

Looking Ahead

There is still work to be done and features we'd love to see from the JupyterBook 2 and MyST-MD teams



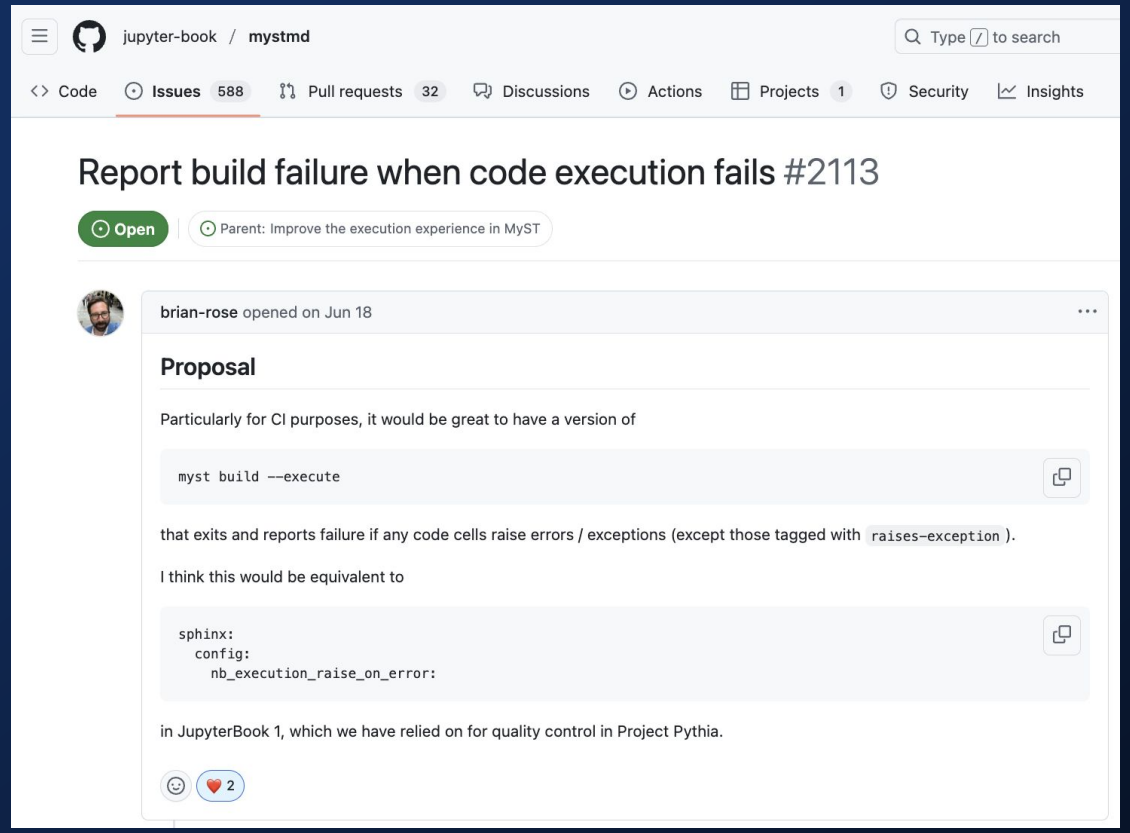
stock.adobe.com/images/woman-with-telescope-and-laptop-seeking-opportunities-man-carrying-light-bulb-symbolizing-new-ideas-ideal-for-teamwork-innovation-creativity-vision-solutions-strategy-simple-flat-metaphor/1744606942


Pythia Projects Board
Add status update
Insights
Workflows 6
Open issues
Iterations
Prioritization
Labels
New view
Still far to go (many opened issues)
-is:closed
87
Discard
Save
Title
Repository
Iteration
Assignees
Status
Labels
Priority
High 11
1 This repo needs tests #6 ProjectPythia/cookbook-actions Iteration 21 dcamron On Pause hackathon infrastructure High
2 ADD: Add content from other packages (Ex. wradlib, LROSE, et... #68 ProjectPythia/radar-cookbook mgrover1 Backlog content High
3 Import error when running surface_currents.ipynb on Binder #12 ProjectPythia/xbatcher-ML-1-cookbook Iteration 20 To-Do bug High
4 Footers are missing #530 ProjectPythia/pythia-foundations Iteration 28 To-Do infrastructure JOSE submission High
5 Footers missing #530 ProjectPythia/projectpythia.github.io Iteration 28 To-Do infrastructure High
6 Elevate the blog #520 ProjectPythia/projectpythia.github.io Iteration 28 Backlog infrastructure High
7 Leverage MyST Cross-Referencing in Contribution Guides #538 ProjectPythia/projectpythia.github.io Backlog High
8 Information on citations and bibliographies in the Cookbook g... #431 ProjectPythia/projectpythia.github.io Backlog content High
9 Cookbook Gallery Desired Features #8 ProjectPythia/cookbook-gallery To-Do infrastructure High
10 MyST builds report success when code execution fails #150 ProjectPythia/cookbook-actions To-Do infrastructure High
11 Binderbot and migrating workflows to > Python 3.10 #139 ProjectPythia/cookbook-actions To-Do infrastructure High
Add item
Medium 36
12 Update the Team page? #287 ProjectPythia/projectpythia.github.io In Progress content Medium
13 nightly build health checks and failing notebooks #53 ProjectPythia/cookbook-template erogluorhan infrastructure Medium
14 Review gallery tags #203 ProjectPythia/projectpythia.github.io Iteration 23 hackathon infrastructure Medium
15 Add overarching "how to get involved" page #148 ProjectPythia/projectpythia.github.io Backlog community content Medium
16 Internal Relative Links broken in Binder version of pages #311 ProjectPythia/pythia-foundations Backlog bug infrastructure Medium
17 Set up automated testing of environment on different platforms #283 ProjectPythia/pythia-foundations Iteration 22 jukent To-Do infrastructure Medium
18 Add interactive and 3D plotting to Matplotlib content #239 ProjectPythia/pythia-foundations Backlog content Medium

Build failure notifications

MyST builds report success when code execution fails #150

Open



Serious regression in our testing and support capabilities

Try: `myst build --execute --strict`

So many new tabs

“external” links to pages hosted by
separate GitHub repositories **open in new tab**

~30 published GitHub repositories in a trench coat
pretending to be one site



instagram.com/p/CsxEmPVJIgB/
@mvsarts

Extend site parts (i.e. the footer)

Manually added to 4 key sites (no Cookbooks)

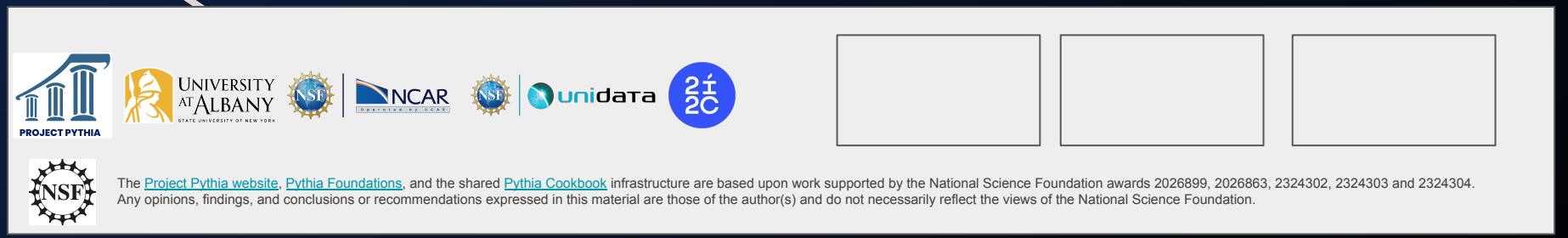
Where we were

Where we are

Where we want to be





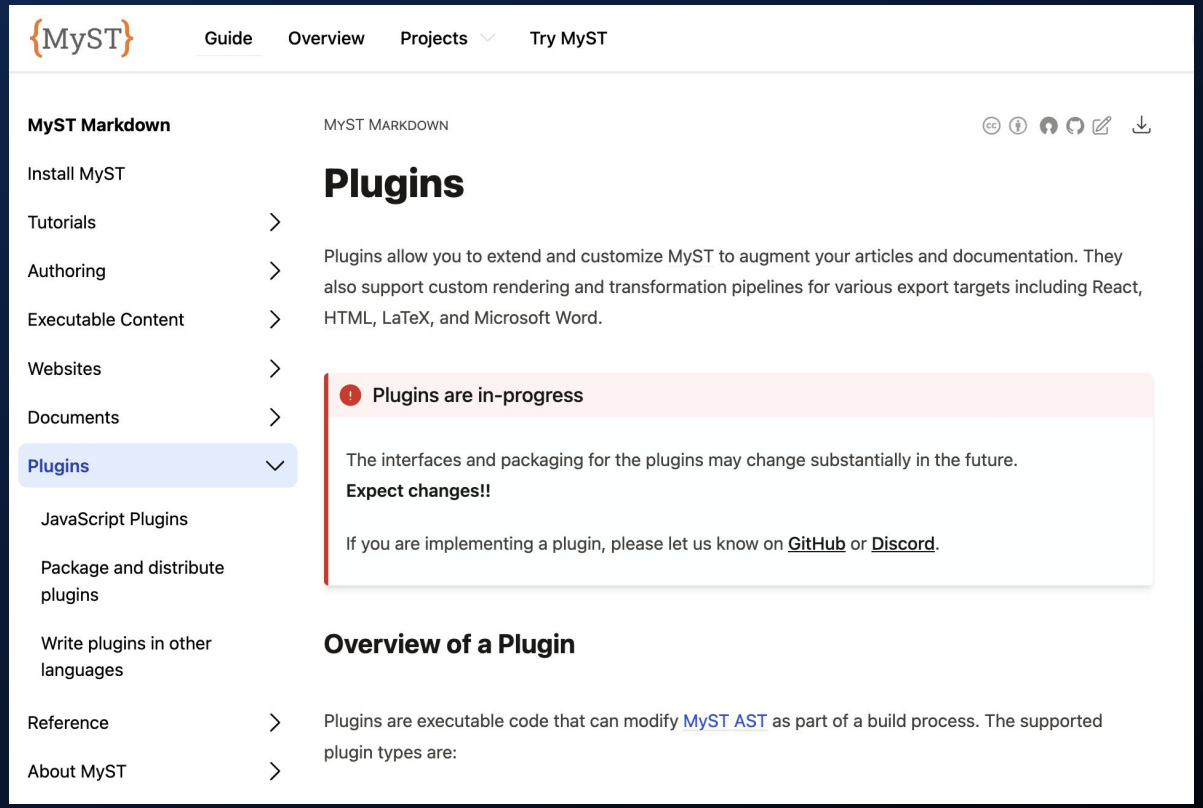


Gallery filtering

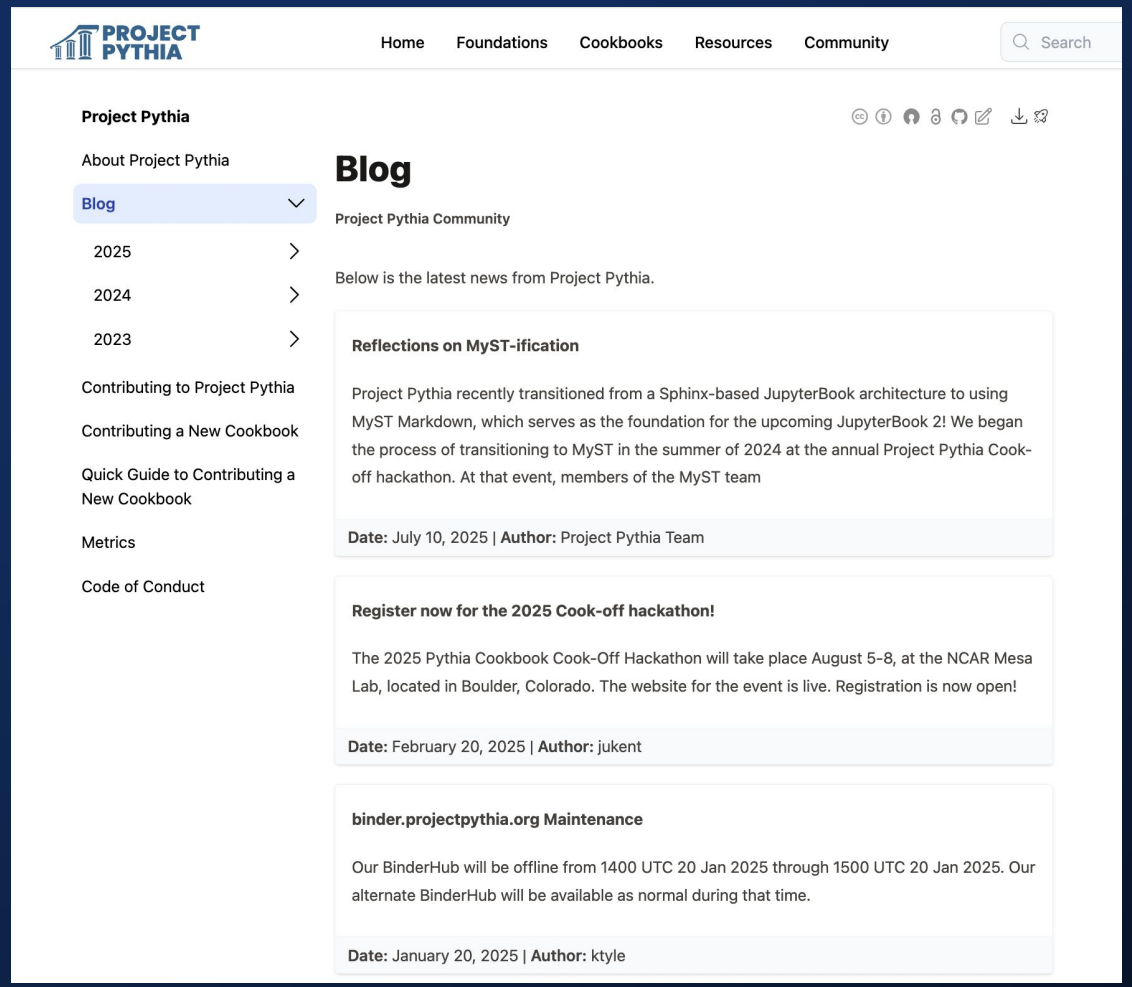
We have many cards in our galleries.

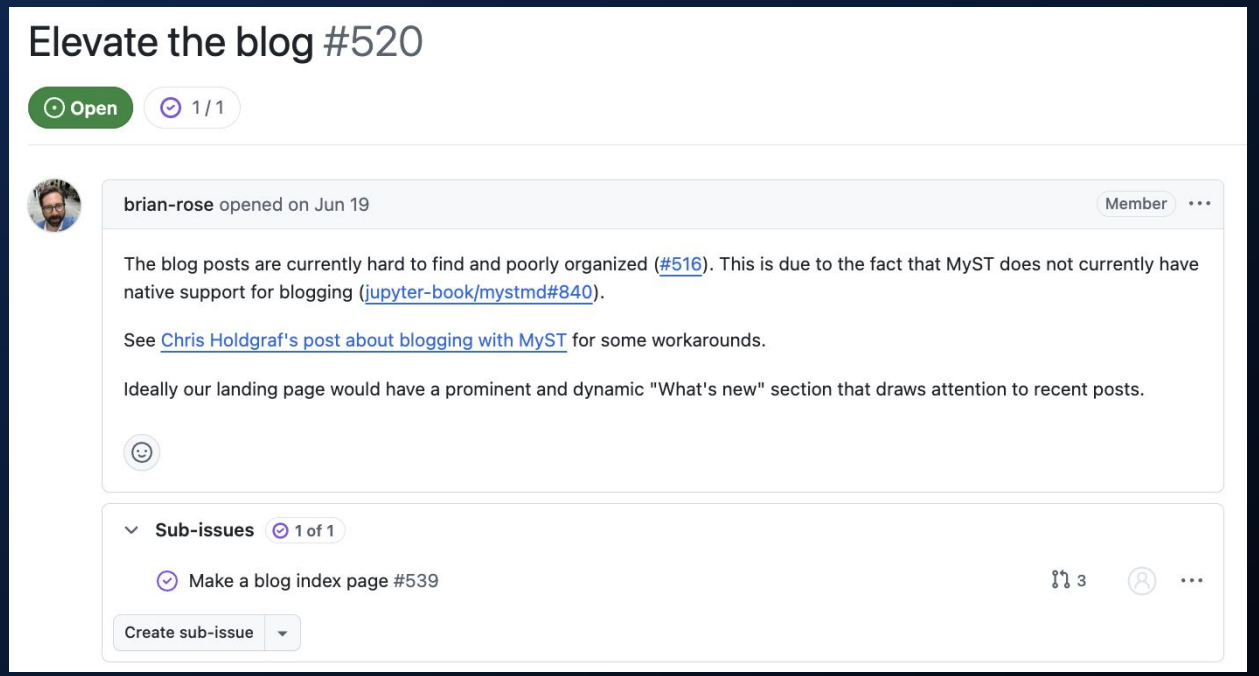
- 91 resources in the Resource Gallery
- 25 Cookbooks in the Cookbooks Gallery

Allow users to **sort by the intersection** of multiple tags (domain, package, format) for a more targeted list.



Blog functionality





TOC **manually edited** to put blog posts in chronological order

Summary

Contact me: jkent@ucar.edu

Headaches from JupyterBook 1/ Sphinx-based infrastructure

↓

Completed the lion's share of work to transition to MyST-MD and be Jupyter Book 2 ready this summer

↓

More work to be done and functionality we'd like to leverage on the way

projectpythia.org



Huge shout out to everyone who was involved in our MyST-transition sprint days:

- Drew Camron
- Rowan Cockett
- Katelyn FitzGerald
- Robert Ford
- Angus Hollands
- Julia Kent
- Christian Okyere
- Brian Rose
- Kevin Tyle

Want to get involved? Join us at our next community meeting on **November 18th 9 AM PT**