Reimagining Python Education for Geoscience: Lessons from Project Pythia's Modernization

SIParCS Internship

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Mentors: Julia Kent, Orhan Eroglu

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About Me

Introduction

- I’m an undergraduate at Colby College, studying Mathematics and Computer Science.
- Passionate about open-source, and web development

What I worked on this summer

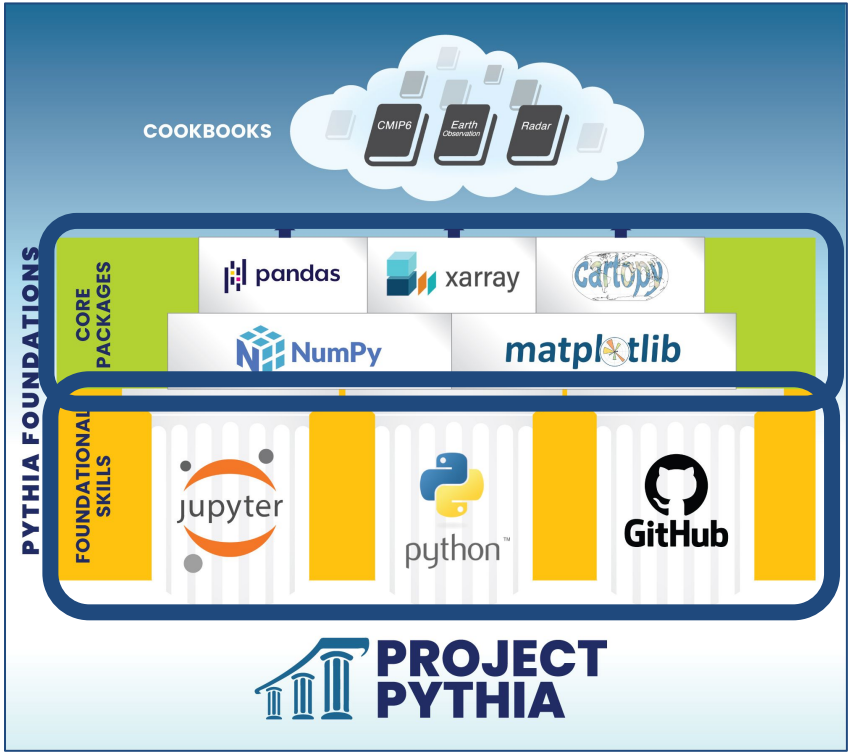
- This summer, I worked with the Project Pythia team to modernize and improve their educational infrastructure.
- My role focused on helping transition from Sphinx-based (Jupyter Book) to MyST Markdown (Jupyter Book 2) for improved maintainability and cross-referencing
- Additionally, I helped design some UI components of the project like the footer.

What is Project Pythia?

Mission: An open-source platform teaching Python to geoscientists.

Our structure includes:

- **Foundational Skills:** Jupyter, Python, and GitHub
- **Core Packages:** NumPy, pandas, xarray, matplotlib, cartopy



Why We Do What We Do

Importance

- Used by scientists around the world
- Supports community-driven learning

Map of Total Foundation Active Users by Country

This map displays the number of active users per country for Pythia Foundations for the entire life of Project Pythia.

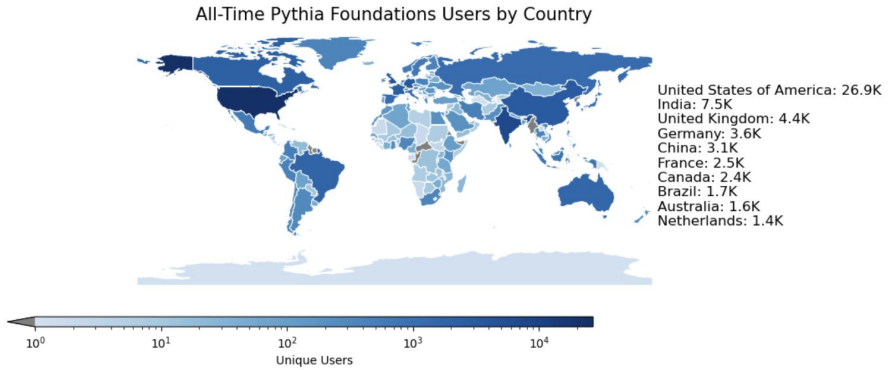
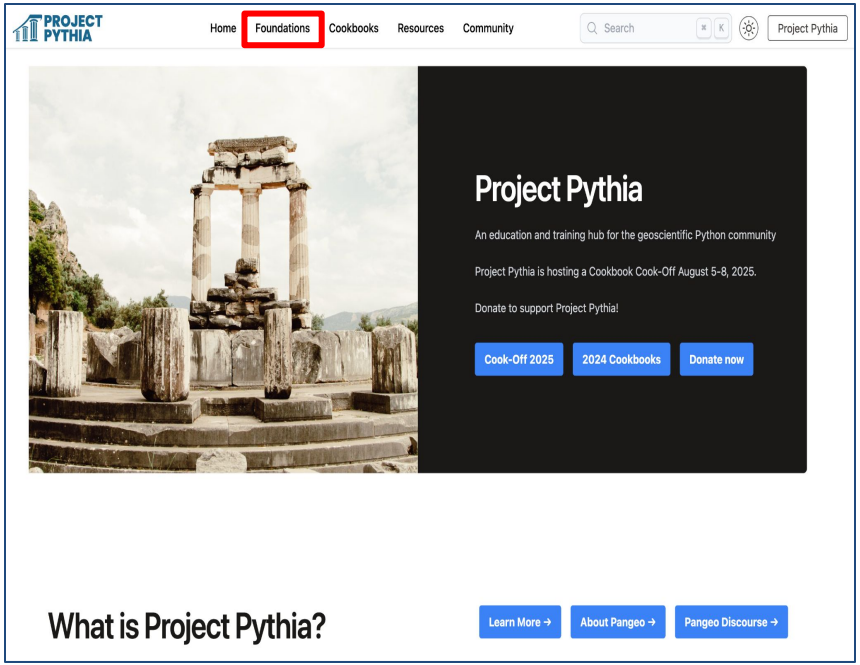


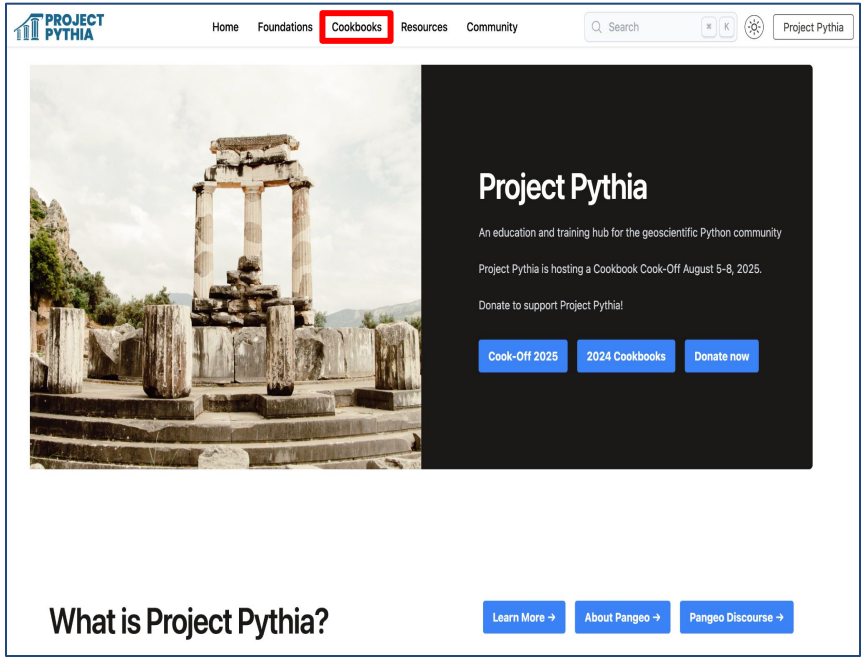
Figure 3: Map of the number of active users per country for Pythia Foundations for the entire life of Project Pythia.

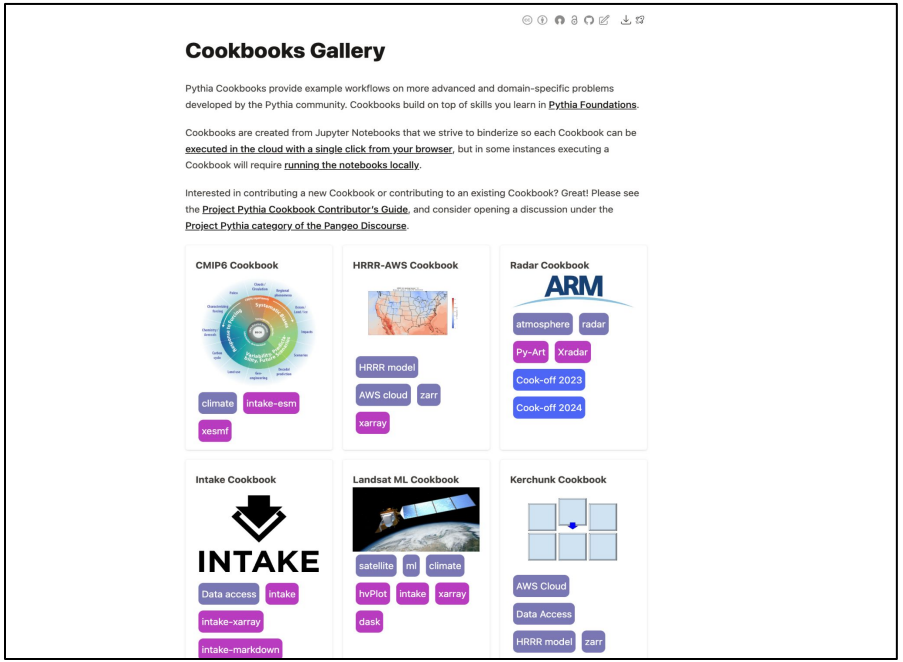
Foundations Page



Foundations: Jupyter Book teaching fundamental Python skills and packages

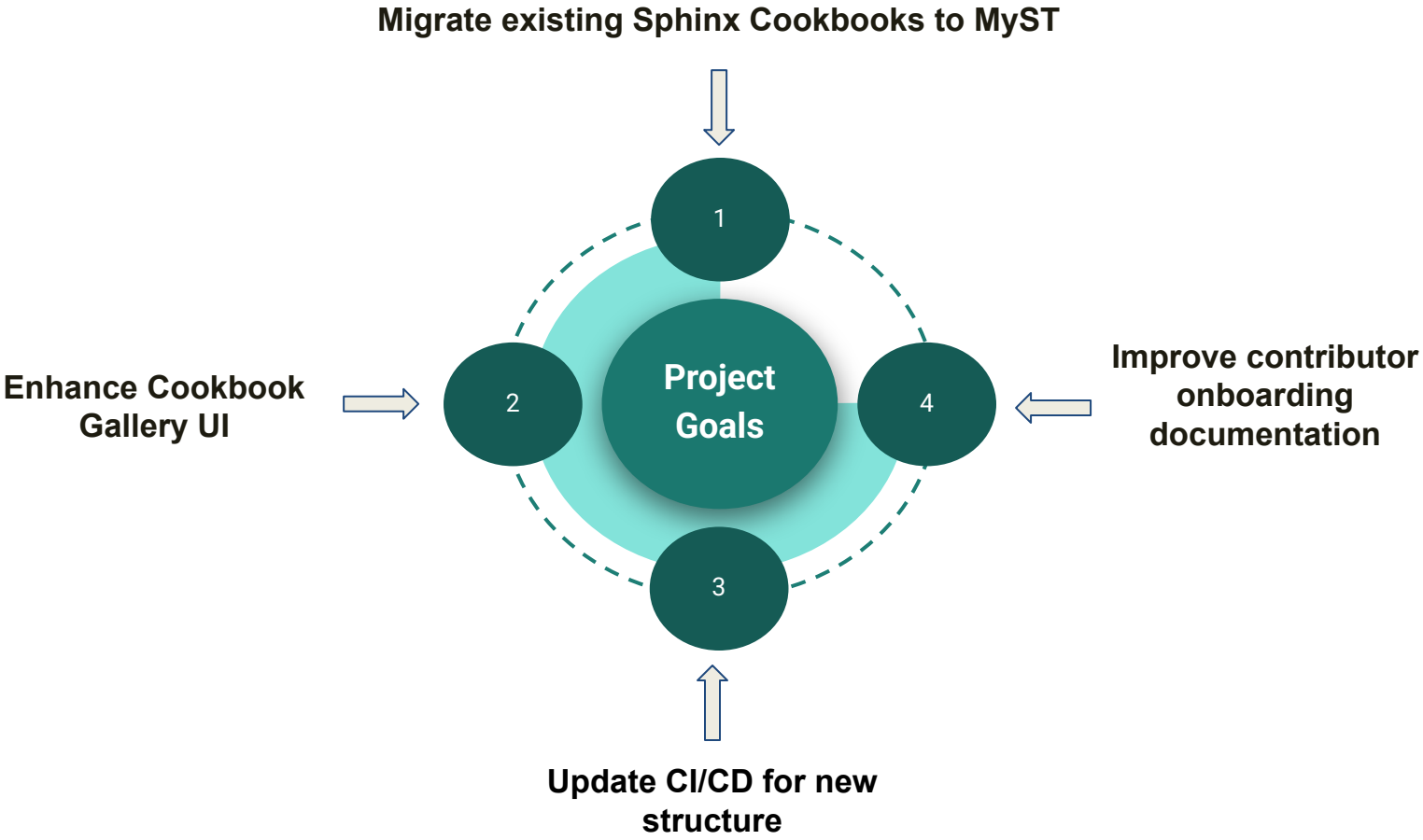
Cookbooks Page



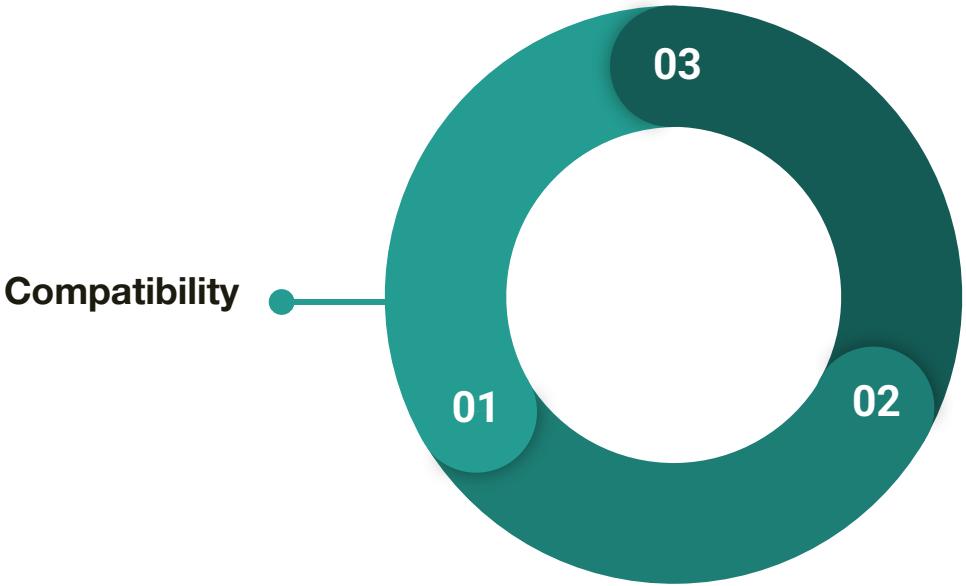


Cookbook: Smaller domain-specific Jupyter Books that demonstrate end-to-end workflows.

Project Goals



Why Migrate?



Compatibility

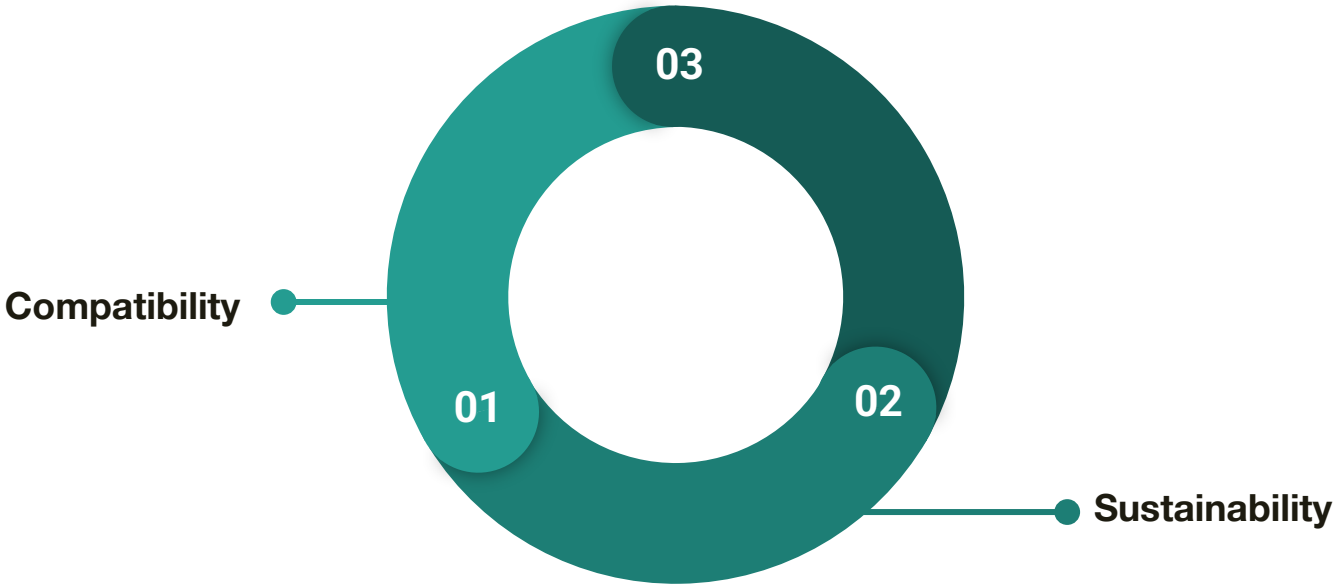
Problem

Jupyter Book 2 dropped support for Sphinx-style content.

Attempting to build Sphinx-based Cookbooks led to:

- Frequent build errors
- Broken navigation
- Inconsistent rendering across browsers and devices

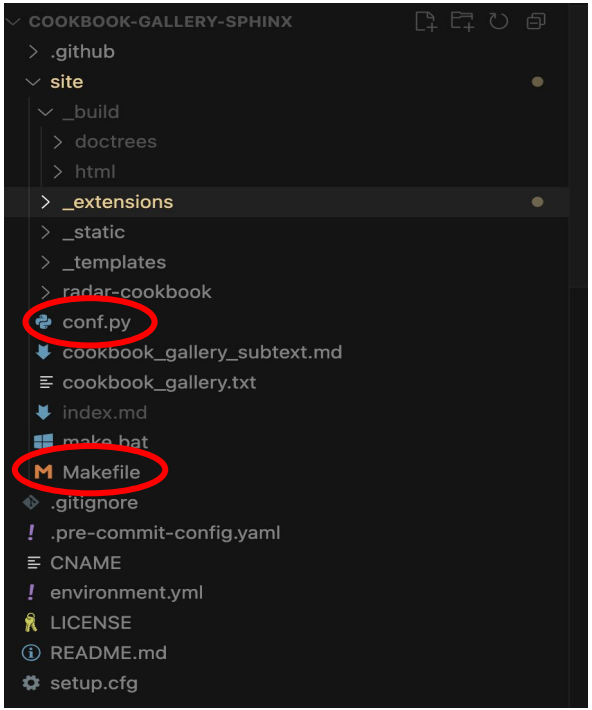
Why Migrate?



Sustainability

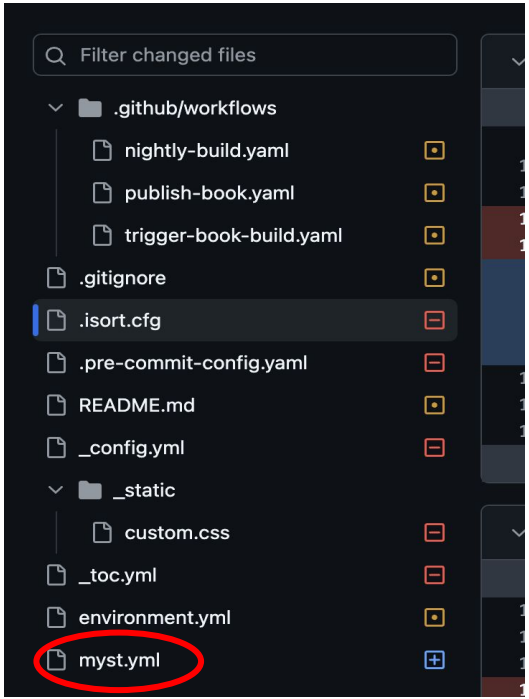
Problem

- The old Sphinx-based setup had too much **boilerplate code** in each repository

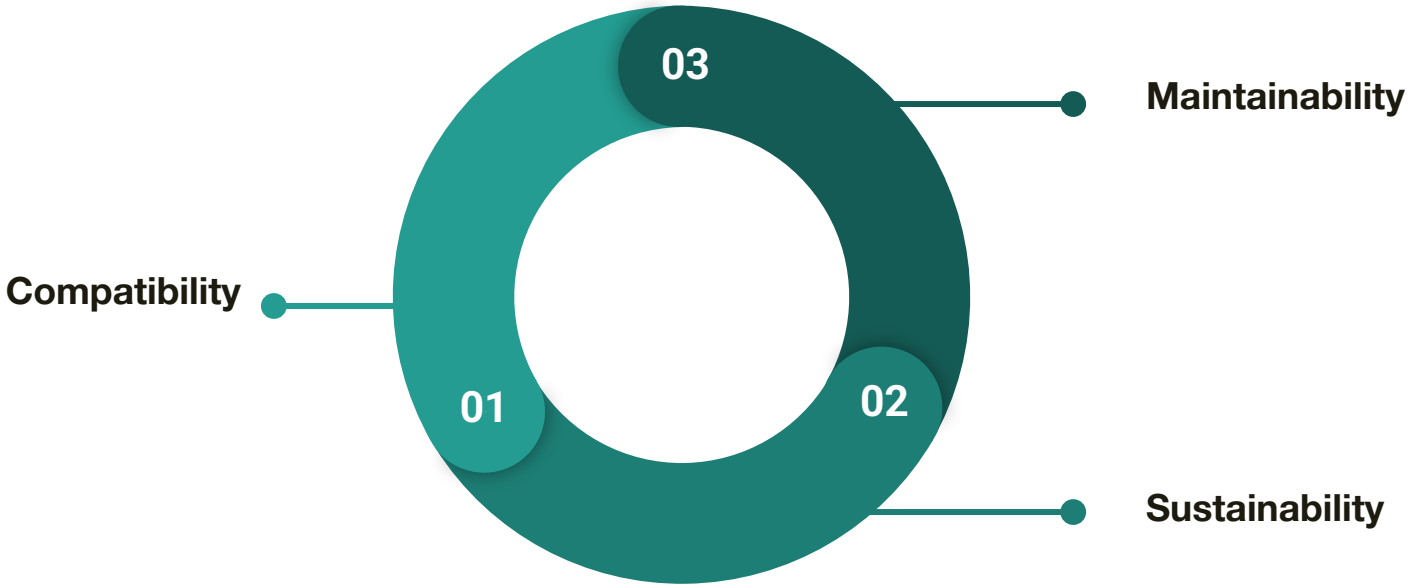


Solution

- MyST Markdown offers minimal setup: **fewer** files and **easier configuration**



Why Migrate?



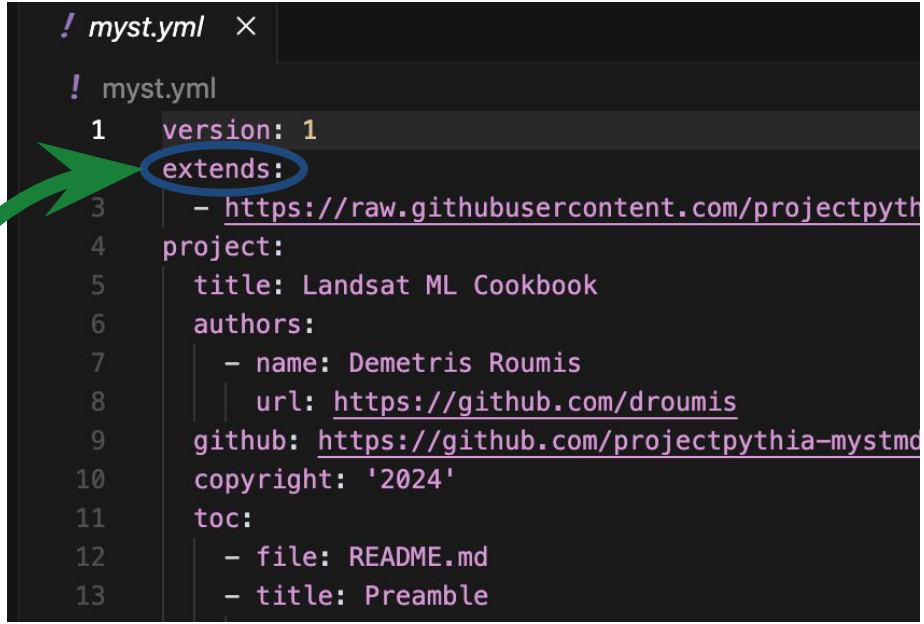
Maintainability

Problem

- Project Pythia has **75+** GitHub repositories
- In Sphinx, updating things like the footer or navbar had to be done **manually** in every repo
- This was **time-consuming** and often led to **inconsistencies**

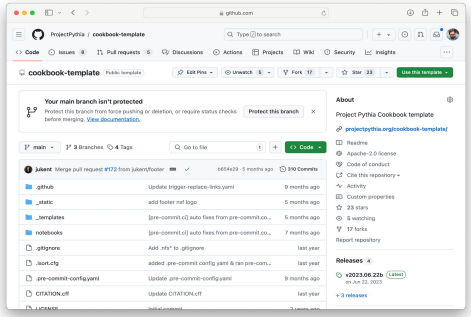
Solution

- MyST solves this with the ***extends*** keyword



How To Migrate

Unexecuted notebooks, environment description, config files



All dropped into a copy of Pythia's [Cookbook Template](#) repository

PROJECT PYTHIA

GitHub Actions

binder

Jetstream2

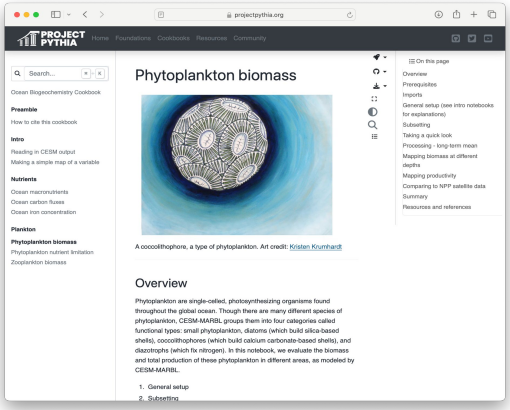
jupyter {book}

GitHub Pages

Rendered Cookbook is fully reproduced from sources:

- For any push to main branch

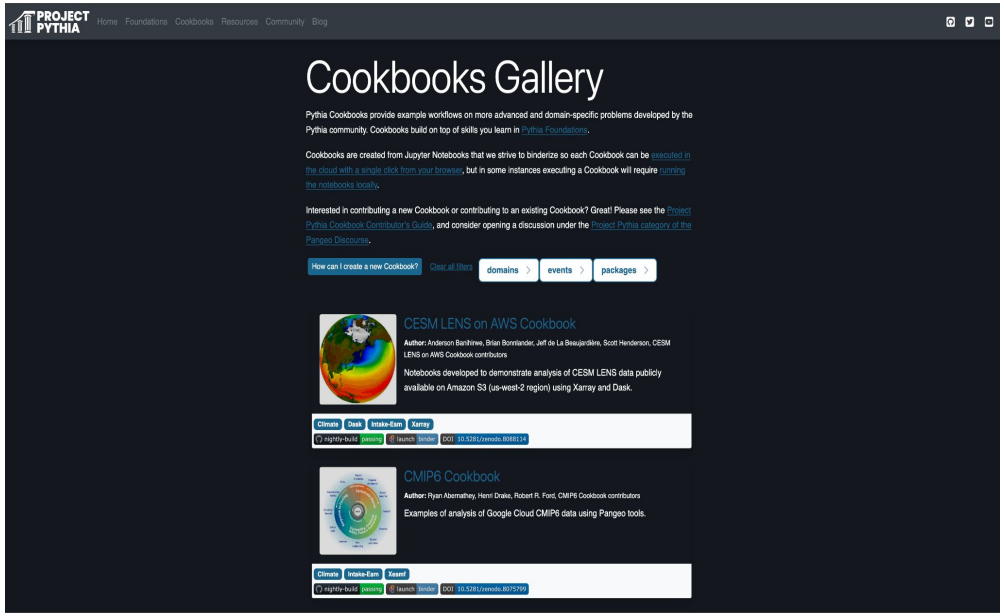
Publicly visible, binderized web pages



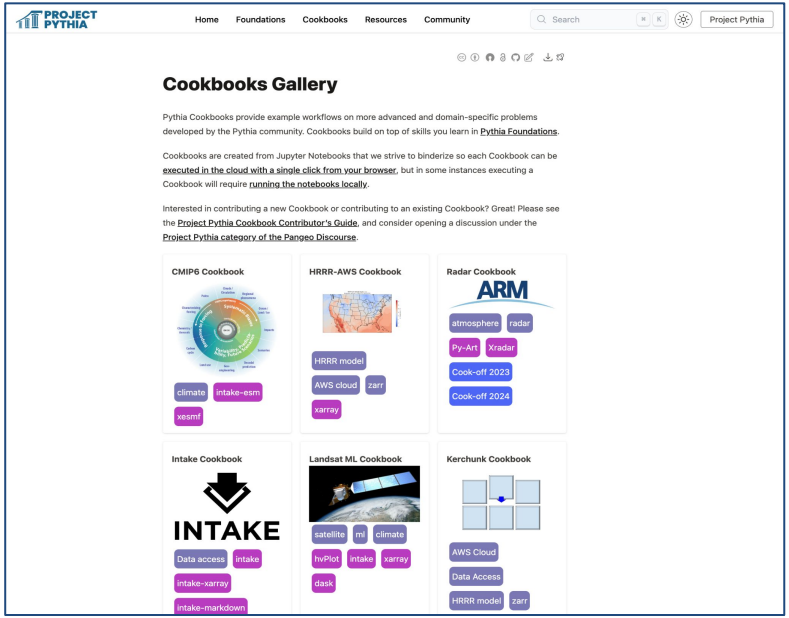
From the [Ocean Biogeochemistry Cookbook](#) by Lev Romashkov and Kristin Krumhardt

Sample Images of Mystified Books

Before



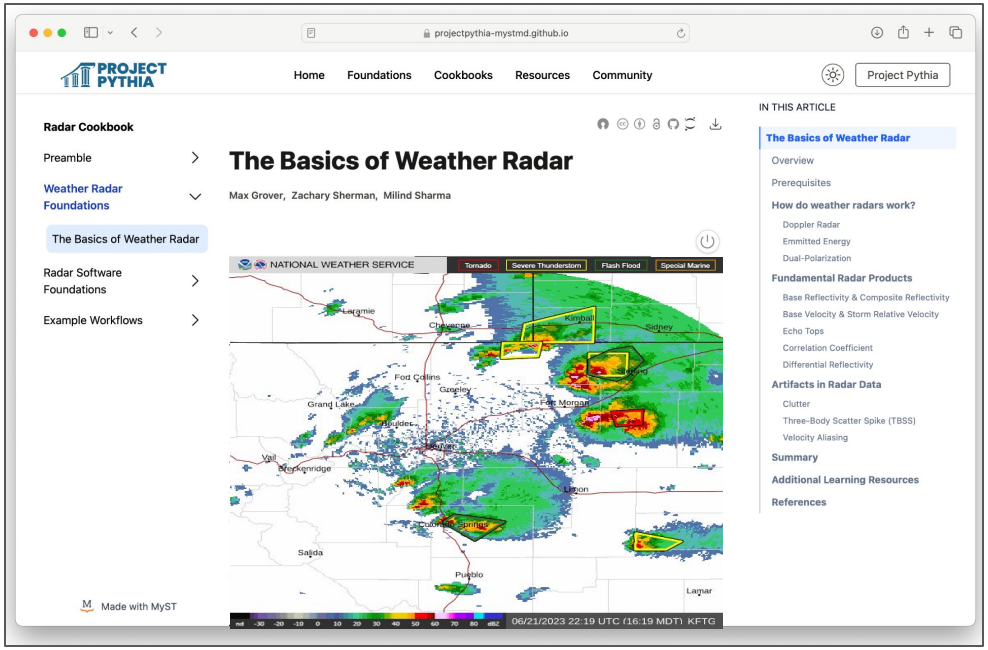
After

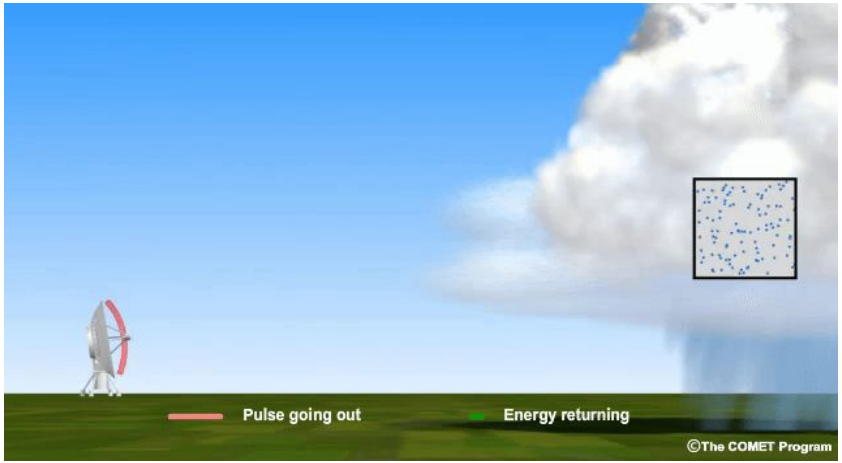


Cookbooks Gallery Page

- Contains all the current cookbooks

Sample Images of Mystified Cookbooks

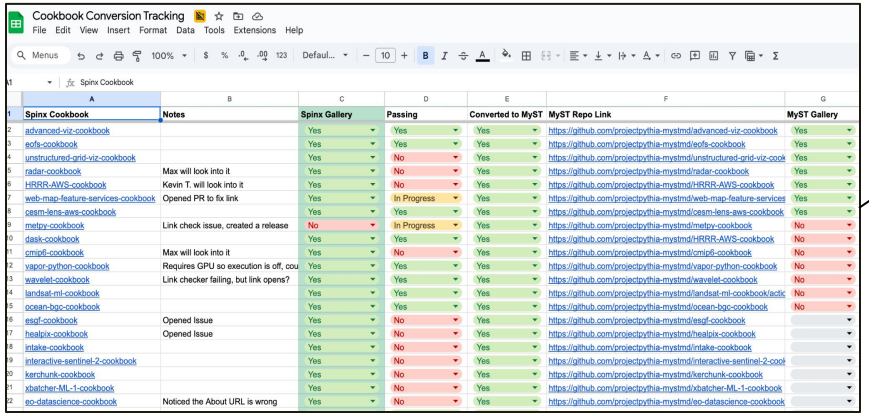




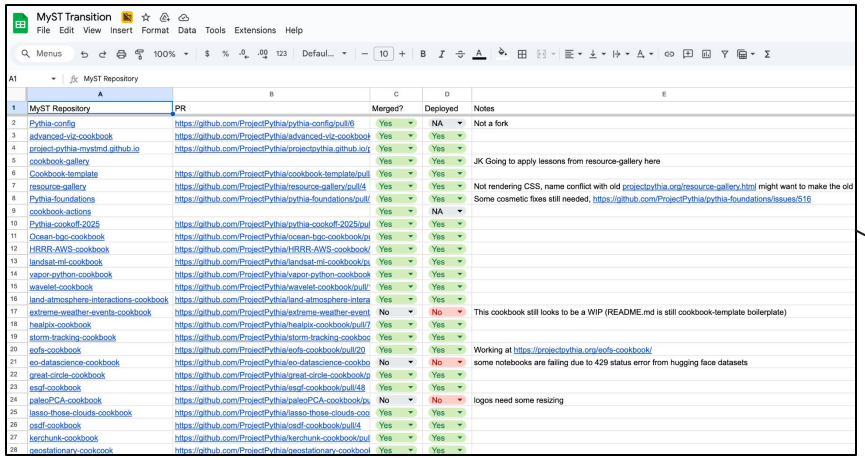
Radar Cookbook

- A domain-specific tutorial that guides users through working with radar reflectivity data using Python tools such as **xarray**, **metpy**, and **matplotlib**

Cookbook Conversion



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	



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/p	Yes	Yes	
HRRR-AWS-cookbook	https://github.com/ProjectPythia/HRRR-AWS-cookbook/	Yes	Yes	
landsat-ml-cookbook	https://github.com/ProjectPythia/landsat-ml-cookbook/p	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

Compared:

- 53 Sphinx Cookbooks
- 17 MyST Cookbooks

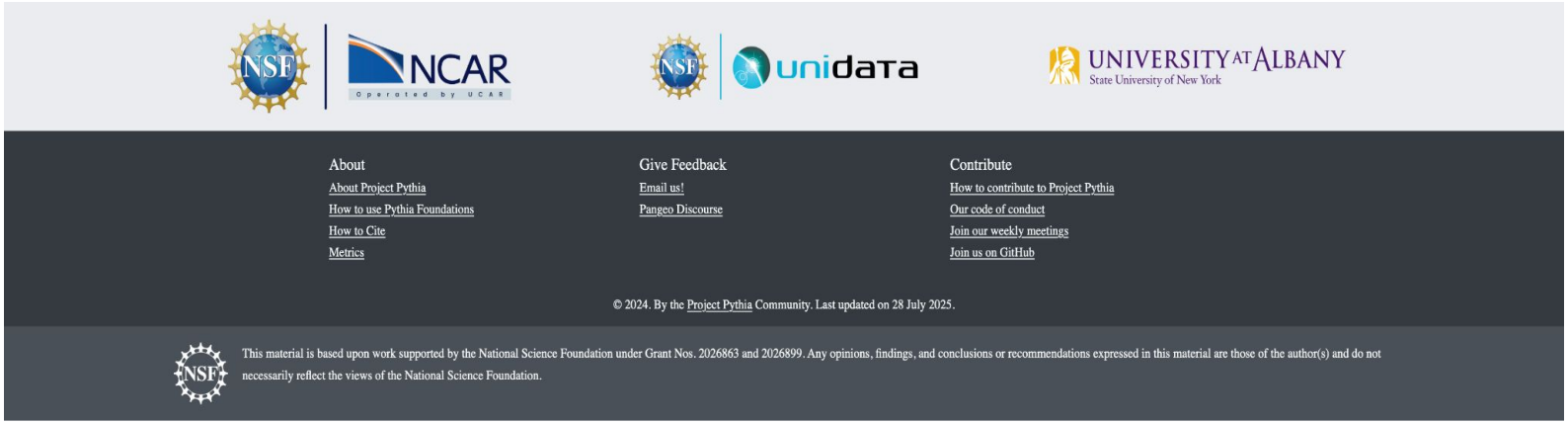
Created migration tracker spreadsheet:

- Build status
- Gallery status
- Notes on conversion success

Transition to Myst

Old Footer vs New Footer

Before



After
(still in prod)

Summary

The Transitioning Process

- Sphinx-based Jupyter Book → MyST Markdown format
- Static pages with rendering issues → Improved HTML, CSS, and JavaScript
- Fragmented documentation → Streamlined Contributor Guides and templates

Next Steps

Next Steps

- Add newly converted Cookbooks to the Gallery
- Finalize Cookbook Gallery UI fixes (filtering, rendering, navigation)
- Polish and publish Contributor Guides
- Open pull requests to merge MyST changes back into main repositories and scrub any stale unused code
- Hackathon/ Cook Off – **August 5 - 8**

Thank you

Special thanks to **Julia Kent** for her mentorship, and guidance throughout this internship. Her feedback made this a truly rewarding and educational experience.

Additional thanks to all the **Pythia Team** for all the resourceful collaborations, and **MystMD Team** for launching timely releases to support the project.

GitHub

PROJECT PYTHIA

References

1. Project Pythia. The Pythia Foundations Book and Cookbooks. Retrieved from: https://projectpythia.org
2. Executable Books. Jupyter Book Documentation (MyST Markdown). Retrieved from: https://jupyterbook.org
3. MyST Markdown. MyST Configuration Reference. Retrieved from: https://mystmd.org
4. NCAR SIParCS Program (2025). Summer Internships in Parallel Computational Science. Retrieved from: https://www.cisl.ucar.edu/outreach/internships
5. Jackson School of Geosciences, UT Austin. Geoscience fieldwork photo. Retrieved from: https://www.jsg.utexas.edu/geo2.jpg
6. NPR. Scientific collaboration in the field. Retrieved from: https://npr.brightspotcdn.com/dims4/.jpg

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