A Practical Guide to Measuring Project Sustainability

Birds of a Feather (BoF) Session

CORSA & CASS Metrics Working Group

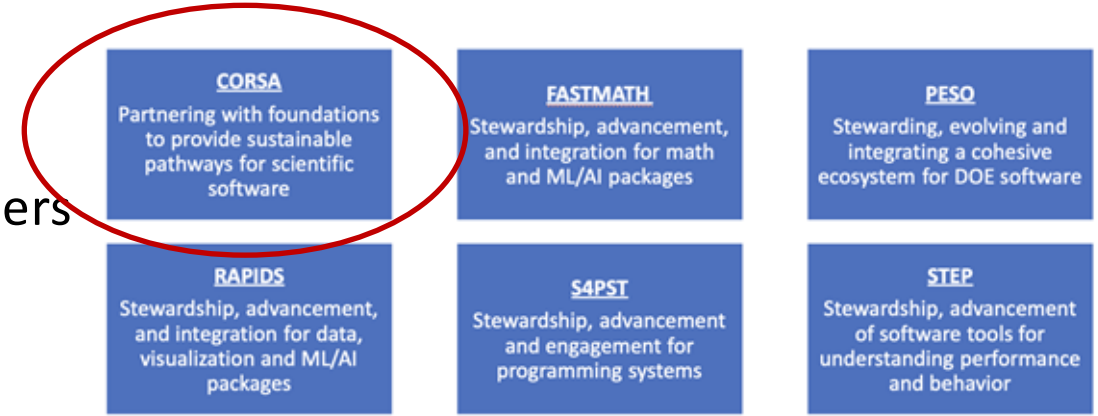
Feb 12, 2026 – 11:00 am-12:30 pm – 90 Minutes

This work was supported by the U.S. Department of Energy, Office of Science, Office of Advanced Scientific Computing under contract number DE-AC05-00OR22725.

CASS: Stewardship and Advancement of the Scientific Software Ecosystem

- **Inward-facing activities:** Strengthening software products
  - Improve development practices, sustainability, quality, and trustworthiness
  - Enhance user experience and integration within the broader ecosystem
- **Outward-facing activities:** Community engagement and discovery
  - Curate and evolve the software portfolio
  - Help teams connect with and grow their user communities
  - Enable the broader community to discover and adopt useful software

CASS Members



Sponsored by the Department of Energy, Office of Advanced Scientific Computing Research

Engage with CASS!

- Learn about CASS:
  - https://cass.community/about/
- Join the CASS Announcement list (low-volume):
  - http://eepurl.com/iRiSnY
- Find out more about our **software products**
  - Catalog: https://cass.community/software/
  - Collected as part of the Extreme-Scale Scientific Software Stack (E4S)
- Participate in **CASS Working Groups**
  - Impact Framework, Integration, Metrics, Software Ecosystem, User-Developer Experience, Workforce
  - https://cass.community/working-groups/

Session Objectives

Introduce the CASS Sustainability Metrics Report and its three core dimensions

Discuss practical implementation strategies for projects at different maturity levels

Identify which metrics are most valuable to project leads and stakeholders

Gather feedback for CORSA on how to best support projects in metric collection

Agenda

10 min	**Introduction & Context** CORSA, SSOs, and the Metrics Working Group
20 min	**Deep Dive: Three Dimensions** Impact, Sustainability, and Quality metrics
10 min	**Implementation Strategies** A phased approach and avoiding pitfalls
10 min	**CORSA Support & Feedback** How we can help your project
35 min	**Interactive Breakout** Metrics in practice - group discussions
5 min	**Wrap-up & Next Steps** Resources and contact information

CORSA & Software Sustainability Organizations

CORSA

Center for Open-Source Research Software Stewardship and Advancement

Provides guidance and resources for research software projects

Helps navigate sustainability assessment and planning

Bridges software engineering research with scientific practice

Software Sustainability Organizations (SSOs)

Understand the status and progress of their software projects

Desire to measure the effect on scientific discovery

Want to manage stewardship activities through metrics

Goal: Help research software achieve long-term sustainability and maximize scientific impact

Why Sustainability Metrics Matter

16%

of open source projects by major tech companies become inactive within 12 months

12+

months of commit gaps strongly indicate project abandonment

35-55%

chance contributors return after breaks under 1 year

Metrics enable projects to:

- Gain evidence-informed guidance for strategic planning
- Identify early warning signs before problems escalate
- Support funding and institutional backing using data
- Benchmark progress and demonstrate improvement over time

"Projects should see metrics as tools for strategic planning and ongoing improvement rather than absolute measures."

The Three Dimensions of Software Sustainability

IMPACT

Adoption, citation, and integration into research workflows

SUSTAINABILITY

Community health, governance, and structural viability

QUALITY

Technical excellence and user-facing features

Each dimension contains multiple metric categories with specific indicators and measurement methods

IMPACT Dimension

Assesses software influence based on adoption, citation, and integration into research workflows

Software Citation & Adoption

Example Indicators:

- Number of citations/mentions
- CITATION.cff and codemeta.json metadata
- DOI resolutions or downloads
- Dependent packages count
- Inclusion in training materials
- Spack recipe instances

Field Research Impact

Example Indicators:

- Non-bibliographic DOI references
- HPC Center recommendations
- Facility software stack listings
- Forks/stars (community uptake)
- Scientific discoveries enabled
- New methodologies supported

High-impact software attracts resources and institutional support, creating positive feedback loops

SUSTAINABILITY Dimension

Encompasses human and structural elements crucial for long-term project resilience and continuity

Governance & Community

- Codes of Conduct
- Contributor Guidelines
- Governance Documents
- Licensing & FAIR Compliance

Engagement & Outreach

- Issue Response Time
- New Contributors/Cycle
- Welcomeness Metrics
- Psychological Safety

Financial Sustainability

- Funding Source Diversity
- Multi-year Commitments
- Non-grant Income
- RSE Award Programs

Institutional Support

- Dedicated RSE Positions
- Industry Adoption
- Staff Contributions
- Career Path Support

Community Health & Longevity

Active Maintenance

- Commit activity patterns & gaps
- Maintenance mode indicators
- Release frequency analysis
- Contributor abandonment forecasting

Project Longevity

- Active contributors over time
- Contributor diversity & retention
- Knowledge distribution (bus factor)
- Succession planning indicators

Collaboration & Interoperability

- Cross-project collaborations and integration with broader scientific software ecosystem
- Dependency analysis: Spack, conda-forge, PyPI, domain-specific package managers
- API standards compliance and data format standardization
- Participation in external events, cross-project forums, domain-wide mailing lists

Vibrant communities offer redundancy in maintainership, diverse perspectives, and knowledge transfer mechanisms

QUALITY Dimension

Technical excellence and user-facing features that reduce maintenance burdens while enhancing confidence

Reliability & Robustness

Static analysis, security practices, CERT guidelines, test coverage

Development Practices

CI/CD, testing, linting, peer code review, issue trackers

Reproducibility

Containerization, FAIR4RS compliance, workflow support

Usability

Documentation, API references, tutorials, UEQ scores

Portability

Spack/Conda/CMake, containers, architecture compatibility

Performance

Benchmarking, scalability, GPU utilization, SCI metrics

Quality Measurement Infrastructure

Static Analysis	DeepSource, CodeAnt.ai, SemGrep, Valgrind, Heaptrack
Security	SAST/DAST tools, dependency scanning, CERT Guidelines compliance
Performance	HPC Challenge, SPEC benchmarks, NVIDIA Nsight, Score-P, Darshan
Environmental	ISO/IEC 21031:2024 SCI, CodeCarbon, Green Software Foundation tools

Emerging: Environmental Efficiency (SCI) and HPC Scalability metrics for sustainable computing

CASS Metrics & OpenSSF Best Practices Alignment

How CASS metrics map to the OpenSSF Best Practices Badge (Passing Level)

CASS Metric	OpenSSF Requirement	Alignment
Governance & CoC (4.2.1)	Contribution & Governance	**Strong**
Licensing & FAIR (4.2.2)	License (OSI-approved)	**Direct**
Active Maintenance (4.2.3)	Change Control / Releases	**Aligned**
Engagement (4.2.4)	Bug Reporting / Issue Tracker	**Partial**
Reliability & Security (4.3.1)	Security & Static Analysis	**Strong**
Development Practices (4.3.2)	Testing & Version Control	**Direct**
Reproducibility (4.3.3)	Build System	**Aligned**
Portability (4.3.5)	Installation	**Aligned**

CASS Unique: Scientific Impact, Community Psychology, HPC Performance | OpenSSF Unique: Security Reporting Mechanisms

Beyond OpenSSF: What CASS Metrics Uniquely Addresses

OpenSSF focuses on security and basic development practices. CASS metrics adds critical dimensions for scientific software sustainability.

IMPACT

(Not in OpenSSF)

- Citation counts & bibliometrics
- DOI resolutions & downloads
- Dependent package analysis
- HPC facility adoption
- Training material inclusion
- Field research references
- Community uptake signals

SUSTAINABILITY

(Expanded beyond OpenSSF)

- Psychological safety metrics
- Contributor retention rates
- Bus factor analysis
- Funding source diversity
- Multi-year commitments
- Institutional RSE support
- Cross-project collaboration

QUALITY

(HPC-specific additions)

- HPC portability (Spack, E4S)
- Accelerator compatibility
- Performance benchmarks
- Energy efficiency (SCI)
- Container availability
- Cross-platform testing
- Reproducibility indicators

Why it matters: OpenSSF is necessary but not sufficient for scientific software sustainability

CASS metrics help demonstrate value to funders, track community health, and ensure long-term viability

Implementation Quick Wins

Satisfy OpenSSF Best Practices Badge while targeting CASS metrics

Immediate Wins	Ensure LICENSE, CONTRIBUTING.md, CODE_OF_CONDUCT.md, and README.md are present *CASS 4.2.1 & 4.2.2*
Process	Formalize release notes and semantic versioning practices *CASS 4.2.3*
Technical	Implement automated test suite and CI/CD pipeline *CASS 4.3.1 & 4.3.2*
Security	Create SECURITY.md describing how to report vulnerabilities privately *CASS 4.3.1*

Prioritize CASS Sections 4.2 (Sustainability) and 4.3 (Quality) to achieve OpenSSF compliance

CORSA Open Source Document Templates

Ready-to-use guidance, examples, and templates for your project's governance documents

Governance

Minimum Viable Governance, decision-making structures, leadership models

Codes of Conduct

Contributor Covenant templates, enforcement guidance, community standards

Contributing Guides

How to contribute, development workflows, PR templates

Licenses

License selection guidance, OSI-approved options, attribution requirements

Roadmaps

Project planning templates, milestone tracking, feature prioritization

DEI Resources

Inclusive community practices, the DISCOVER Cookbook, accessibility

github.com/corsa-center/oss-documents

69 stars • CC-BY-4.0 licensed • Community-contributed examples from NumPy, Astropy, Kubernetes & more

Implementation Roadmap

A phased approach to sustainability assessment

1

Getting Started

Months 1-3

2

Building Momentum

Months 4-12

3

Long-term Development

Year 2+

Start with foundational indicators and progress to more complex metrics over time

Phase 1: Getting Started (Months 1-3)

Goal: Establish baseline understanding of project health and implement foundational governance

1 Establish baseline assessment using automated tools/dashboards for basic metrics

2 Implement essential governance documentation: CODE_OF_CONDUCT.md, CONTRIBUTING.md, LICENSE

3 Set up basic citation tracking using available APIs and tools (Semantic Scholar, OpenAlex)

4 Assess current funding situation and document sustainability planning needs

Phase 2: Building Momentum (Months 4-12)

Goal: Deepen insights with targeted metrics and formalize sustainability planning

1. Expand community health monitoring using CHAOSS tools where appropriate
2. Implement quality assurance practices appropriate to project size and context
3. Develop stakeholder engagement around sustainability planning
4. Adopt a sustainability dashboard for regular monitoring and reporting

CHAOSS GrimoireLab provides multi-repository analysis, AI-powered sentiment analysis, and community health indicators

Phase 3: Long-term Development (Year 2+)

Goal: Embed sustainability as a core strategic function and contribute to the broader community

1 Establish comprehensive sustainability strategy based on metric insights

2 Implement advanced measurement approaches where warranted and cost-effective

3 Contribute to validation research by sharing experiences and outcomes

4 Mentor other projects in sustainability assessment and planning

Become a leader by contributing knowledge back to the broader research software community

Avoiding Common Pitfalls

1. Metric Overload

Focus on metrics most relevant to your project context and goals. Prioritize outcomes, not raw output.

2. Automation Bias

Remember that automated tools provide indicators, not definitive assessments. Context matters.

3. Context Ignorance

Adapt frameworks to your specific domain, culture, and organizational context.

4. Validation Assumptions

Acknowledge uncertainty and use metrics as guidance rather than definitive measures.

5. Resource Mismatch

Ensure metric implementation efforts align with available resources and priorities.

6. Stakeholder Skepticism

Ensure transparent communication about why metrics are tracked and how they influence decisions.

7. Inaction on Insight

Create a process for regularly reviewing metrics and converting findings into actionable steps.

CORSA Support Services

How CORSA Can Help Your Project

Dashboards & Visualization

Custom sustainability dashboards for monitoring and reporting project health metrics

Automated Mining

Repository mining tools and automated collection of sustainability indicators

Qualitative Interviews

Structured interviews to capture insights that automated tools cannot detect

Templates & Guides

Documentation templates, assessment guides, and best practice recommendations

Mentorship

One-on-one guidance for implementing sustainability practices in your project

Community Connection

Connect with other projects facing similar sustainability challenges

CORSA Sustainability Dashboard

A hub for showcasing the sustainability of scientific open source projects

Project Catalog

Browse and search scientific software projects with sustainability metrics at a glance

Dependencies Explorer

Visualize package dependencies across the scientific software ecosystem

Spack Dependencies

Analyze Spack package relationships and build configurations

Project Metric Visualizer

Interactive charts showing sustainability trends over time

Track your software's live metrics easily from the dashboard

Case Study: HDF5 on the Dashboard

HDF5: A Model for Sustainability Tracking

HDF5 is a high-performance data management library used across scientific domains—from climate modeling to genomics. The CORSA dashboard tracks sustainability metrics, demonstrating mature, well-maintained research software.

Dashboard Metrics Visible for HDF5:

Activity

Stars, forks, commit frequency, release history

Community

Contributors over time, issue response patterns

Dependencies

Downstream packages that depend on HDF5

Quality

CI status, documentation, license compliance

Why This Matters: Projects can **calibrate their success measures** alongside proven models like HDF5, providing stakeholders with consistent data that clearly highlights development progress.

Discovering Software Usage & Dependencies

CORSA is developing tools to help projects understand their downstream impact

The Challenge: Who is using my software?

Understanding which applications depend on your software package—directly or through third-party libraries—is crucial for measuring impact, prioritizing maintenance, and communicating value to stakeholders.

Direct Discovery

- Package manager analysis
- Repository dependency graphs
- Build system inspection

Third-Party Integration

- Spack, conda-forge, PyPI APIs
- Libraries.io integration
- GitHub dependency insights

Benefits: Quantify real-world adoption • Identify high-impact dependents • Prioritize compatibility & support • Strengthen funding proposals

What Do You Need From CORSA?

Open Discussion

- What specific tools would help you collect and visualize metrics?
- What templates or documentation would be most useful?
- What training or mentorship would help your team?
- What barriers do you face in implementing sustainability practices?
- How can we better connect projects with similar challenges?

Your feedback shapes how CORSA supports the research software community

Interactive Breakout Session

Metrics in Practice

35 Minutes

- Split into small groups based on project maturity or domain
- Record thoughts in shared collaborative documents
- Each group will discuss the prompts on the following slide
- We'll reconvene to share key insights

Group by: Project maturity level, Scientific domain, or Organization type

Breakout Discussion Prompts

1

Start with 2 to 3 metrics that are most relevant to your current project, or include more if desired.

Consider: Where is your project in its lifecycle? What are your immediate priorities?

2

Identify the metrics you would like CORSA to help gather and monitor.

Consider: Tool availability, team buy-in, data privacy, time/resource constraints

3

Identify how would you like to see the collected metric visualized/presented?

Consider: What story do you want the metrics to tell? What would dependent software care about most?

Key Takeaways

Three dimensions—Impact, Sustainability, and Quality—provide a comprehensive view of software health

Start small with foundational metrics, then expand as your project matures

Metrics are tools for strategic planning, not absolute measures—context matters

Avoid common pitfalls: metric overload, automation bias, and inaction on insights

CORSA is here to support you with tools, templates, and mentorship

Resources & Next Steps

CASS Sustainability Metrics Report

Full report with detailed metric descriptions, measurement methods, interview questions, and implementation guidance. Available under CC BY 4.0 license.

CORSA Website

https://corsa.center/

Contact

info@corsa.center

Related Resources

- CORSA OSS Documents (templates)
- CHAOSS Community Metrics
- OpenSSF Best Practices Badge
- FAIR4RS Principles
- ISO/IEC 21031:2024 SCI Specification

Subscribe to the CORSA mailing list at https://corsa.center/ to stay updated!

This work was supported by the U.S. Department of Energy, Office of Science, Office of Advanced Scientific Computing under contract number DE-AC05-00OR22725.

Thank You!

Questions & Discussion

CORSA & CASS Metrics Working Group

info@corsa.center | https://corsa.center/