

SERVIR West Africa 2024 Training Program on Data Stewardship and the CoreTrustSeal Requirements: Session 7, R05 Requirement

Robert R. Downs, PhD

Center for International Earth Science Information Network (CIESIN)
Columbia Climate School, Columbia University

Coordinated by AFRIGIST

September 11, 2024, 13:00 – 14:30 GMT (9:00 - 10:30 a.m. EDT)



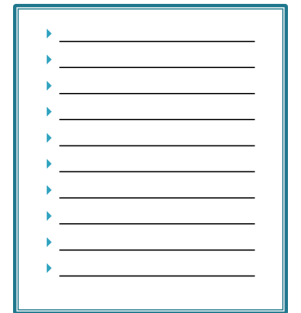
Brief Review of Previous Webinars

- Data Stewardship Concepts, Principles, and Certification Instruments
 - CoreTrustSeal, ISO 16363, Nestor DIN 31644
- Preservation, Designated Community, Sustainability
- CoreTrustSeal Certification requirements
- Organizational aspects of Data Stewardship
- CoreTrustSeal Requirements 2020-2022: R01-R16
- Setting the stage for Planning to Meet the CoreTrustSeal Requirements
- Motivation and R0 Requirement
- R01, R02, R03, R04 Requirements (Sessions 3-6)



SERVIR West Africa 2024 Training Program on Data Stewardship and CoreTrustSeal Requirements

- Key topic:
 - R05 Requirement
- Instructional format
 - Lecture, questions, and discussion
- Session will be recorded
 - Recording will be posted on the SERVIR West Africa website



Outline for Current Session

- Progress Planning and Participant Introductions (5 minutes)
- Scheduling Training Sessions and CoreTrustSeal Application Preparation (5 minutes)
- Review of Homework: Draft Self-Assessment Responses in Template (20 minutes)
- CoreTrustSeal Requirement 05 and Examples of Responses (30 minutes)
- Homework: Draft Self-Assessment Response (10 Minutes)
- Introduction to CoreTrustSeal Requirement 06 (10 Minutes)
- Preparing for Next Session (10)



Progress Planning and Introductions

- CoreTrustSeal application template created for each repository
 - CERSGIS, ICRISAT FMNR, AFRIGIST, AGRHYMET, CSE
- Each repository uses template to progressively revise their self-assessment
- Please put additional repository names and your email address in Zoom chat
- Brief introductions by those who have not previously introduced themselves



Scheduling Training Sessions and CoreTrustSeal Application Preparation

- Plan to schedule sessions twice monthly enabling time for progress
 - Repositories complete template sections between sessions ✓
 - Each session includes review and introduction to subsequent section ✓
- Next session planned for Wednesday, October 9, 2024, 13:00-14:30 GMT
 - Topics: R06 Requirement and Introduction to R07 Requirement

Review of Homework: Self-Assessment in CoreTrustSeal Application Template

- **R0 Background Information and Context**

- Re3data identifier
- Repository Type
- Overview – Brief Description of Repository
- Brief Description of the Designated Community
- Level of Curation Performed
- Cooperation and Outsourcing to third parties, partners, and host organizations
- Applicants renewing – Summary of Significant Changes Since Last Application



- **R01 Mission & Scope**

- The repository has an explicit mission to provide access to and preserve digital objects.

- **R02 Rights Management**

- The repository maintains all applicable rights and monitors compliance.

- **R03 Continuity of Service**

- The Repository has a plan to ensure ongoing access to and preservation of its data and metadata.

Questions about previous homework to compose draft responses in template

- Identifying resources that address a challenging requirement
 - Can we start listing and describing current resources that address the requirement?



- Needed resources
 - What resources are needed to comply with a challenging requirement?

- Good progress on CoreTrustSeal application templates for R0:
 - Featured examples: CERSGIS, AGRHYMET, and ICRISAT FMNR



- Let's all continue making progress on the CoreTrustSeal application templates

Review repository self-assessment in template:

Draft a response to

CoreTrustSeal Requirement R04: Legal & Ethical

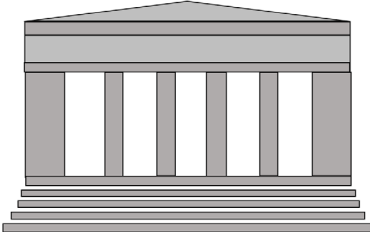
The repository ensures to the extent possible that data and metadata are created, curated, preserved, accessed and used in compliance with legal and ethical norms.

Review of Homework in Template: R04 Legal & Ethical Self-Assessment

- Describe how the repository addresses legal and ethical standards
 - Identify legal and ethical standards adopted by repository
 - Link to sources of legal and ethical standards adopted by repository
 - How repository complies with legal and ethical standards
- Describe guidance for depositors on legal and ethical standards
 - Information provided to depositors about legal and ethical standards
 - Link to online guidance for depositors that describes legal and ethical standards
 - Information requested from depositors on legal and ethical compliance
- Describe repository procedures for legal and ethical compliance
 - Data or metadata that could include disclosure risk
 - How repository mitigates potential disclosure risk
 - Staff training on legal and ethical compliance



CoreTrustSeal Requirement R05 Governance & Resources





Requirement R05 Governance & Resources

R05. The repository has adequate funding and sufficient numbers of staff managed through a clear system of governance to effectively carry out the mission.

Self-Assessed Compliance Level:

This Requirement reflects a need for transparency of financing, governance, responsibilities, and decision making. Evidence should demonstrate that the repository has a clear system of governance and sufficient human and financial resources to carry out its mission.



Requirement R05 Governance & Resources

The response statement and evidence should include references to the following items:

- Descriptions and diagrams of governance bodies, groups and hierarchies.
- Timescales for provision and renewal of funding for operational costs and recruitment; it is understood that permanent, ongoing funding cannot be perfectly quantified or guaranteed.
- Evidence that the repository is, or is hosted by, a recognized institution (supporting long-term stability and sustainability) appropriate to its Designated Community.
- Demonstrate that the repository can meet its obligations, including sufficient funding, staff resources, IT resources, and a budget for external engagement when necessary.

The availability of appropriate expertise is covered under Expertise (R06)

Requirement R05 Governance & Resources (Continued)



Responses and evidence should demonstrate that the repository can meet its obligations, including sufficient funding, staff resources, IT resources, and a budget for external engagement when necessary. The organization's governance/management decision-making processes and the entities involved should be clear e.g. through organizational diagrams.

Evidence should include how often periodical renewal of funding occurs. It is acknowledged that repositories work under a range of different funding models, and often with limited resources, but demonstrating awareness of these issues is important to trustworthiness. It is acknowledged that past funding is not a guarantee of future funding, but it may be indicative to state the historical timescale of the repository.

Other relevant information could include the balance of structural versus project funding, the total number of full time equivalent (FTE) employees, and the proportions of staff employed on a permanent or temporary basis.

R05 Governance & Resources Example Evidence: About SEDAC Webpage (Excerpt)



About SEDAC

User Working Group

Privacy

User Registration

SEDAC, the Socioeconomic Data and Applications Center, is one of the Distributed Active Archive Centers (DAACs) in the Earth Observing System Data and Information System (EOSDIS) of the U.S. National Aeronautics and Space Administration. Focusing on human interactions in the environment, SEDAC has as its mission to develop and operate applications that support the integration of socioeconomic and earth science data and to serve as an "Information Gateway" between earth sciences and social sciences.

Project Office

SEDAC User Services
+1(845)365-8920
ciesin.info@ciesin.columbia.edu

Alex de Sherbinin, SEDAC Manager

Sri Vinay, Deputy SEDAC Manager & Systems Engineer

Susana Adamo, SEDAC Co-Project Scientist

Robert Downs, SEDAC Co-Project Scientist

Kytt MacManus, Assistant SEDAC Systems Engineer

Hans Bosch, SEDAC IT Security Point of Contact & Operations Manager

R05 Governance & Resources Example: AADC CoreTrustSeal Application (Excerpt)



The AADC is funded by the Australian Government as part of the Australian Antarctic Division (AAD) (<https://www.antarctica.gov.au/>), which is a division of the Department of Climate Change, Energy, Environment and Water (DCCEEW). As such it has considerable funding stability. The activities of the AADC are considered highly important by both the AAD and DCCEEW, and it is extremely unlikely that funding will be removed.

→ The Antarctic Treaty (<https://www.ats.aq/e/antarctic treaty.html>) which is currently signed by 56 countries (Australia was one of the 12 original signatories in 1959), explicitly states that "Scientific observations and results from Antarctica shall be exchanged and made freely available".

The AADC was created in 1995 to fulfil that obligation.

Budgets are assigned by the Australian Government - DCCEEW - and the AAD on an annual basis.

The AADC currently has 23 staff, including:

- A Manager
- An Information Management team of 7 (including the Senior Scientific Data Coordinator, primarily responsible for the cataloguing and archival of data)
- - A Mapping and GIS team of 10
- A Technology and Development team of 5

In 2022, the AAD released a 20 year strategic plan for the organisation, detailing priorities and objectives (and thereby demonstrating a commitment to funding) - <https://www.antarctica.gov.au/about-us/antarctic-strategy-and-action-plan/>

→ In early July, 2023, the AAD underwent an organisational restructure. As part of this, the AADC became part of Science Branch, and the AADC manager now reports to the AAD Chief Scientist (who reports to the head of the AAD). A high level organisational structure of DCCEEW, incorporating the AAD can be found here - <https://www.dcceew.gov.au/about/who-we-are/structure> ...

R05 Governance & Resources Example: DANS CoreTrustSeal Application (Excerpt)

- Compliance level: Implemented: the requirement has been fully implemented by the repository – 1

In the “Collaboration Agreement” [14] (see R1) it is laid down that DANS is funded by NWO and KNAW. These two organisations, the two major national research organisations of the Netherlands, have agreed to structurally provide lump sum finance to DANS. The current agreement covers the period 2015 – 2025. Furthermore DANS has shown evidence over the years of a well-filled portfolio of externally financed national as well as European projects, that usually run for multiple years. Examples of current SSH related projects are ODISSEI, CLARIAH, SSHOC-NL, OH-SMART, E-RIHS, as well as work in CESSDA and DARIAH [18]. The ratio between structural and incidental (project) funding is roughly 70 to 30%.

Sufficient numbers of appropriately qualified staff are available. The total staff of DANS currently consists of around 60 staff members (48 FTE), divided over 55% permanent and 45% temporary staff. ...

There is an organisational chart available for the DANS organisation as a whole [8].

R05 Governance & Resources Example: ICPSR CoreTrustSeal Application (Excerpt 1 of 2)

- Compliance level: Implemented: the requirement has been fully implemented by the repository - 1

With over 60 years of service, ICPSR is the world's largest archive of digital social and behavioral science data. It operates as a unit within the Institute for Social Research at the University of Michigan and is based in Ann Arbor. [1] ICPSR's diversified funding model [2] ensures stability and reliability through three main revenue sources: grants and contracts; annual membership dues from more than 800 member institutions; [3] and tuition from the annual Summer Program in Quantitative Methods and its over 1,000 participants. [4] [5] For the 2023-24 fiscal year, the total offline budget for ICPSR was \$20 million, with membership revenue of \$4.5 million and Summer Program revenue forecasted at approximately \$2.1 million. [5] The largest externally-funded project, Research Data Ecosystem, is a \$38 million dollar commitment over five years from the National Science Foundation. [6]

...

A 12-person Council, whose members are elected by the ICPSR membership, guides and oversees ICPSR. Council members serve four-year terms, and six new members are elected every two years. The Council makes decisions on administrative, budgetary, and organizational issues on behalf of all ICPSR members. [8]

R05 Governance & Resources Example: ICPSR CoreTrustSeal Application (Excerpt 2 of 2)

ICPSR consists of eight units: Administration; Business and Collection Development; Computing and Network Services; Curation; Membership and Communication; Metadata and Preservation; Product Management; Project Management and User Support; and the Summer Program. Administration handles financial, budgeting, proposal development, procurement, facilities, event planning, and general administration. Business and Collection Development secures funding, engages in outreach to identify valuable data resources to preserve, and provides oversight and guidance for ICPSR's sponsored projects. Computing and Network Services address computing, software development, and systems security needs. Curation prepares social science data collections for permanent archiving and dissemination. Membership and Communication creates awareness and support for ICPSR products and services. Metadata and Preservation sets standards for metadata, preserves digital assets, and maintains the ICPSR Bibliography. Product Management leads cross-functional teams in the development of new software and services and communicates shared product visions across the organization. Project Management and User Support manages topical archives and other sponsored and member-funded projects. The ICPSR Summer Program in Quantitative Methods provides training and instruction in research methods, quantitative analysis, information management, and data stewardship to the broader research community in and around the social sciences. ...

R05 Governance & Resources: Example CSIRO CoreTrustSeal Application (Excerpt 1 of 3)

CSIRO has a long history and is a recognised organisation within Australia and worldwide. The longevity of CSIRO as an organisation is described in more detail in R3. CSIRO's main funding is directly from the Australian Government and this funding is more than AUD900 million per year (4). As this funding is based on a triennial funding program, if funding were to cease, CSIRO would have approximately three years notice to plan for the succession of the CSIRO Data Access Portal's collections. CSIRO considers the possibility of it ceasing to operate or changing its scope as highly unlikely.

The CSIRO Data Access Portal is an institutional repository that has been available since 2011. It is a service within the Information Management and Technology (IMT) unit of CSIRO which is under the management of the Chief Operating Officer (2). It is funded within the Information Management and Technology budget.

Governance of the CSIRO Data Access Portal is by three project boards. An organisation chart has been uploaded but has not been made available publicly (Governance.pptx).

CSIRO Data Access Portal is governed by the Data Management Systems Board comprising of:

- Authority and Chair of the Board (IMT)
- Senior Users (Science Business Units)
- Senior Supplier (IMT)
- Deputy Authority (IMT)
- Specialist Advisors (IMT).

...

R05 Governance & Resources: Example CSIRO CoreTrustSeal Application (Excerpt 2 of 3)

National Research Collections Australia will be governed by the NRCA Digital Infrastructure Upgrade Project Board during the development phase of the project and will move to the Data Management Systems Board in 2025. The NRCA Digital Infrastructure Upgrade Project Board includes:

- Product Owners from National Collections and Marine Infrastructure (Digitisation, Australian National Herbarium, Australian National Wildlife Collection)
- Program Manager (IMT)
- Data Management Applications Manager (IMT).

The CSIRO Australian Telescope National Facility (ATNF) Data Access Project Board scope includes Pulsar Observations and CSIRO ASKAP Science Data Archive (CASDA). CASDA is not included in this application as the data is stored and accessed from separate infrastructure on the Pawsey Supercomputing Centre.

The CSIRO Australian Telescope National Facility (ATNF) Data Access Project Board consists of:


- Authority and Chair (IMT)
- Senior Users (Space and Astronomy)
- Senior Supplier (IMT)
- IT Infrastructure Supplier (IMT)
- Pawsey Infrastructure Supplier
- Deputy Authority (IMT).

...

R05 Governance & Resources: Example CSIRO CoreTrustSeal Application (Excerpt 3 of 3)

The project boards play a key element in the Project Management framework and provide direction and advice to the Project Manager that will ensure the project achieves the expected outputs, outcomes, and impacts. The activities in scope are articulated in the approved Project Intent Statements (the Business Cases).

Development and support of the CSIRO Data Access Portal software and infrastructure is undertaken by project managers and project teams. Two project managers support the three project boards. The project teams consist of a pool of thirty one technical and research data services staff with a mix of full-time and part-time roles:

- 
- 10 Software Developers
 - 5 Business Analysts
 - 6 Test Analysts
 - 2 Infrastructure Specialists
 - 2 Solution Architects
 - 6 Research Data Services staff.

The Research Data Services staff support the CSIRO Data Access Portal and liaise with internal and external users. They provide advice and training to CSIRO staff and are involved in setting development priorities based on feedback from users. Enquiries from the user community are triaged by the Research Data Services staff who assist with downloads. Questions outside of their scope are referred to the depositor or relevant contact for Pulsar Observations and National Research Collections Australia. ...

R05 Governance & Resources Example: FITBIR CoreTrustSeal Application (Excerpt 1 of 2)

Utilizing funding available through the FITBIR MOU, CIT and NIH have contracted with Publicis Sapient to provide complementary scientific and technical expertise. The DoD and NIH oversee a portfolio of research on fundamental understanding of TBI as part of NINDS and DoD. NINDS is one of the 27 Institutes and Centers of the NIH (the largest funder of biomedical research in the world) and is widely recognized as a leader in the area of TBI research. Publicis Sapient has extensive experience as a contractor organization working on Federal government IT initiatives.

The Publicis Sapient staff of 34 full-time employees (FTEs) and NIH staff of 3 part time employees (PTE) for FITBIR are split across the following specializations.

1) Software Development (Total (18) FTE and (3) PTE)

- a) Developers: (13) FTE and (3) PTE- responsible for building the platform software deliverables
- b) Quality Assurance: (3.5) FTE-ensures solution meets business requirements and is free from errors and defects.
- c) Requirements Analyst: (2) FTE- responsible for ensuring that the requirements of the business clients are captured and documented correctly before a solution is developed and implemented.
- d) Infrastructure Engineer: (3) FTE- designs, builds, deploys and maintains the IT infrastructure.

2) Operations Support (Total (7) FTE)

- a) End user support: (7) FTE- Provides business, technical, and scientific expertise.
- b) Data-level curation: (2.0) FTE- Exploring, cleaning, annotating, publishing and presenting structured data sources. PhD expertise provided. ...

R05 Governance & Resources Example: FITBIR CoreTrustSeal Application (Excerpt 2 of 2)

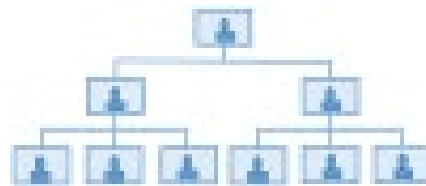
Also, the FITBIR's scientific direction includes the input of Dr. Matthew McAuliffe, who is an expert in the area of biomedical informatics and provides scientific input on how to reuse the data. He leads or is a member of many NIH initiatives including, Trans-NIH BioMedical Informatics Coordinating Committee (BMIC) CDE task force, NIH Scientific Data Councils working groups, and others. The members of FITBIR scientific teams attend scientific meetings and symposia to maintain up to date understanding and training in biomedical informatics and TBI. In addition, FITBIR staff are required to take mandatory training developed and administered by NIH annually in the area of Information Security and Information Management with additional modules specifically if you work with biomedical data. Additionally, professional development coursework is available for technical and non-technical staff via online (such as Lynda.com, O'Reilly) and in person training certification courses.

FITBIR's overarching governance is comprised of a structure that ensures FITBIR's goals are conceived and executed via a framework that defines boundaries to ensure delivery of the strategic vision to the FITBIR stakeholder community. Each committee ensures the right stakeholders are engaged with the Publicis Sapient partners to shape the FITBIR project roadmap.

The FITBIR Governing Committee is comprised of the representatives from the NIH (NINDS) and the DoD as voting members. Additional members may be added in the future. The Governing Committee makes all decisions related to overall strategic vision, operating procedures, and will regularly assess FITBIR activities. ...

R05 Governance & Resources Homework: Self-Assessment in Template

- What is the type, source, and duration (renewal schedule) of funding?
- Describe repository's host institution and relationship to repository
- Describe governance body for repository
- What is the decision-making structure for the services provided?
- How many staff members are in repository and what are their roles?



Introduction to CoreTrustSeal Requirement R06 Expertise & Guidance

CoreTrustSeal Requirement R06 Expertise & Guidance



R06. The repository adopts mechanisms to secure ongoing expertise, guidance and feedback-either in-house, or external.

Compliance Level

Guidance

A repository must identify the skills necessary to deliver the services it offers, and source and maintain those skills either as internal resources or through external engagement. An effective repository strives to accommodate evolutions in data types, data volumes, and data rates, as well as to adopt the most effective new technologies in order to remain valuable to its Designated Community.

CoreTrustSeal Requirement R06 Expertise & Guidance



The response statement and evidence should include references to the following items:

- That guidance and expertise reflects the scientific scope of the repository, if relevant.
- The repository aligns internal recruitment and external engagement with the services it offers.
- The repository ensures that its staff have access to ongoing training and professional development.
- The range and depth of expertise of both the organisation and its staff, including any relevant affiliations (e.g. national or international bodies), is appropriate to the mission.
- In-house advisers, or external advisory committees that include technical, curation, data science, data security, and disciplinary experts.
- How the repository communicates with experts for advice.

CoreTrustSeal Requirement R06 Expertise & Guidance (Continued)



Responses and evidence should demonstrate that the repository has sufficient internal expertise and is linked to a wide network for advice and guidance. Evidence must account for the repository day-to-day activities and the monitoring of potential new challenges on the horizon (community and technology watch).

Preparing for Next Session

Preparing for Next Session: Activities in Your Repository

- Template assigned to each repository for self-assessment
- Review requirements for R05 within the context of your repository
- Discuss among managers and staff within your repository
- Draft responses to R05 for your repository within your template
- Review draft responses to other requirements for consistency

Questions?

Review of the CoreTrustSeal Requirements

CoreTrustSeal Requirements 2023-2025: Context

R0 Context

- General information about the repository
- Re3data identifier
- Repository Type. Select all relevant types from:
 - Generalist or Specialist; Specialist describes scope
- Overview – Brief Description of Repository
- Brief Description of the Designated Community
- Level of Curation Performed. Select all relevant types from:
 - Content distributed as deposited Basic curation – e.g., brief checking, addition of basic metadata or documentation. Enhanced curation – e.g., conversion to new formats during ingest, enhancement of documentation or metadata; Data -level curation – as in C above, but with additional editing of deposited data for accuracy
- Cooperation and Outsourcing to third parties, partners, and host organizations.
- Applicants renewing – Summary of Significant Changes Since Last Application



Source: CoreTrustSeal Standards and Certification Board. (2022). CoreTrustSeal Requirements 2023-2025 (V01.00). Zenodo. <https://doi.org/10.5281/zenodo.7051012>

CoreTrustSeal Requirements 2023-2025: Organizational Infrastructure

- R01 Mission & Scope
 - The repository has an explicit mission to provide access to and preserve digital objects.
- R02 Rights Management
 - The repository maintains all applicable rights and monitors compliance.
- R03 Continuity of Service
 - The Repository has a plan to ensure ongoing access to and preservation of its data and metadata.
- R04 Legal and Ethical
 - The repository ensures to the extent possible that data and metadata are created, curated, preserved, accessed and used in compliance with legal and ethical norms.
- R05 Governance & Resources
 - The repository has adequate funding and sufficient numbers of staff managed through a clear system of governance to effectively carry out the mission.
- R06 Expertise & Guidance
 - The repository adopts mechanisms to secure ongoing expertise, guidance and feedback-either in-house, or external.



Source: CoreTrustSeal Standards and Certification Board. (2022). CoreTrustSeal Requirements 2023-2025 (V01.00). Zenodo. <https://doi.org/10.5281/zenodo.7051012>

CoreTrustSeal Requirements 2023-2025: Digital Object Management

- R07 Provenance & Authenticity
 - The repository guarantees the authenticity of the digital objects and provides provenance information.
- R08 Deposit & Appraisal
 - The repository accepts data and metadata based on defined criteria to ensure relevance and understandability for users.
- R09 Preservation Plan
 - The repository assumes responsibility for long-term preservation and manages this function in a planned and documented way.
- R10 Quality of Service
 - The repository addresses technical quality and standards compliance, and ensures that sufficient information is available for end users to make quality-related evaluations.
- R11 Workflows
 - Digital object management takes place according to defined workflows from deposit to access.
- R12 Discovery & Identification
 - The repository enables users to discover the digital objects and refer to them in a persistent way through proper citation.
- R13 Reuse
 - The repository enables reuse of the digital objects over time, ensuring that appropriate information is available to support understanding and use.



CoreTrustSeal Requirements 2023-2025: Information Technology & Security



- R14 Storage & Integrity
 - The repository applies documented processes to ensure data and metadata storage and integrity.
- R15 Technical Infrastructure
 - The repository is managed on well-supported operating systems and other core infrastructural software and hardware appropriate to the services it provides to its Designated Community.
- R16 Security
 - The repository protects the facility and its data, metadata, products, services, and users.

Source: CoreTrustSeal Standards and Certification Board. (2022). CoreTrustSeal Requirements 2023-2025 (V01.00). Zenodo. <https://doi.org/10.5281/zenodo.7051012>

Online Guidance and Related Resources for Improving Data Stewardship and Attaining CoreTrustSeal Certification 2023-2025

- CoreTrustSeal Standards and Certification Board. (2022). CoreTrustSeal Requirements 2023-2025 (V01.00). Zenodo. <https://doi.org/10.5281/zenodo.7051012>
- CoreTrustSeal Standards and Certification Board. (2022). CoreTrustSeal Trustworthy Digital Repositories Requirements 2023-2025 Extended Guidance (V01.00). Zenodo. <https://doi.org/10.5281/zenodo.7051096>
- CoreTrustSeal Standards and Certification Board. (2022). CoreTrustSeal Trustworthy Data Repositories Requirements: Glossary 2023-2025 (V01.00). Zenodo. <https://doi.org/10.5281/zenodo.7051125>
- CoreTrustSeal Standards and Certification Board. (2022). CoreTrustSeal Revision Working Group Change Log and Associated Materials (v01.00). Zenodo. <https://doi.org/10.5281/zenodo.7051237>
- Apply for CoreTrustSeal Certification: <https://www.coretrustseal.org/apply/>
- CoreTrustSeal Requirements (& webinars): <https://www.coretrustseal.org/why-certification/requirements/>
- CoreTrustSeal Administrative Fee (& waiver): <https://www.coretrustseal.org/apply/administrative-fee/>
- CoreTrustSeal: <https://www.coretrustseal.org/>

Online Resources for Improving Data Stewardship and Attaining CoreTrustSeal Certification (Continued)

- Consultative Committee for Space Data Systems. 2012. Reference Model for an Open Archival Information System (OAIS). CCSDS 650.0-M-2. Also published as ISO 14721:2012. <https://public.ccsds.org/Pubs/650x0m2.pdf>
- Consultative Committee for Space Data Systems (CCSDS). 2011. Audit and Certification of Trustworthy Digital Repositories. CCSDS 652.0-M-1. Also published as ISO 16363:2012. <https://public.ccsds.org/pubs/652x0m1.pdf>
- Group on Earth Observations (GEO). 2016. Global Earth Observations System of Systems (GEOSS) Data Management Principles. http://earthobservations.org/open_eo_data.php#
- Group on Earth Observations (GEO). 2016. Global Earth Observations System of Systems (GEOSS) Data Sharing Principles. http://earthobservations.org/open_eo_data.php#

Online Resources for Improving Data Stewardship and Attaining CoreTrustSeal Certification (Continued)

- Carroll, S.R., et al. 2020. The CARE Principles for Indigenous Data Governance. *Data Science Journal*, 19(1). <https://doi.org/10.5334/dsj-2020-043>
- Lin, D., et al. 2020. The TRUST Principles for digital repositories. *Scientific Data* 7, 144. <https://doi.org/10.1038/s41597-020-0486-7>
- Wilkinson, M, et al. 2016. The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data* 3, 160018. <https://doi.org/10.1038/sdata.2016.18>

Online Resources for Improving Data Stewardship and Attaining CoreTrustSeal Certification (Continued)

- International Science Council (ISC) CODATA international discussion list
 - http://lists.codata.org/mailman/listinfo/codata-international_lists.codata.org
- Research Data Alliance (RDA) <https://www.rd-alliance.org/>
 - <https://www.rd-alliance.org/groups/rdawds-certification-digital-repositories-ig.html>
- Group on Earth Observations (GEO)
 - <https://earthobservations.org/>
- World Data System (WDS)
 - <https://www.worlddatasystem.org/>

Online Resources for Improving Data Stewardship and Attaining CoreTrustSeal Certification (Continued)

- Downs, 2021. Improving Opportunities for New Value of Open Data: Assessing and Certifying Research Data Repositories. *Data Science Journal*. <https://doi.org/10.5334/dsj-2021-001>
- Downs RR. 2019. International Standards for Trustworthy Data Repositories. National Institutes of Health (NIH) Trustworthy Data Repositories Workshop. Rockville, MD. <https://doi.org/10.7916/d8-h7xf-ha70>
- Downs RR. 2021. Adopting the TRUST Principles for Digital Repositories with the GEOSS Data Management Principles and the GEOSS Data Sharing Principles. ESIP 2021 Winter Meeting (Virtual). <https://doi.org/10.6084/m9.figshare.13607747.v1>
- Downs RR, Chen RS. 2016. A Portfolio Approach to a Sustainable Business Model for Scientific Data Stewardship. SciDataCon 2016, Denver, CO. <https://doi.org/10.7916/d8-fae5-cz67>
- Downs RR, Chen RS. 2015. Bridging Disciplines: Assessing the Interdisciplinary Impact of Open Data. 41st IASSIST Annual Conference, Minneapolis, MN. <https://doi.org/10.7916/D8J38SDZ>
- Downs RR, Lehnert KA. 2020. Opportunities for Sharing Resources Among Research Data Repositories. Research Data Alliance 16th Plenary (RDA P16). <https://doi.org/10.7916/d8-kv81-sv37>
- Downs RR, Lehnert KA, Zhang L, Donaldson DR, Silva JR. 2020. Selecting Research Data Repository Platforms for Open Science. RDA P16. <https://doi.org/10.7916/d8-051c-y379>

Thank you!

rdowns@ciesin.columbia.edu