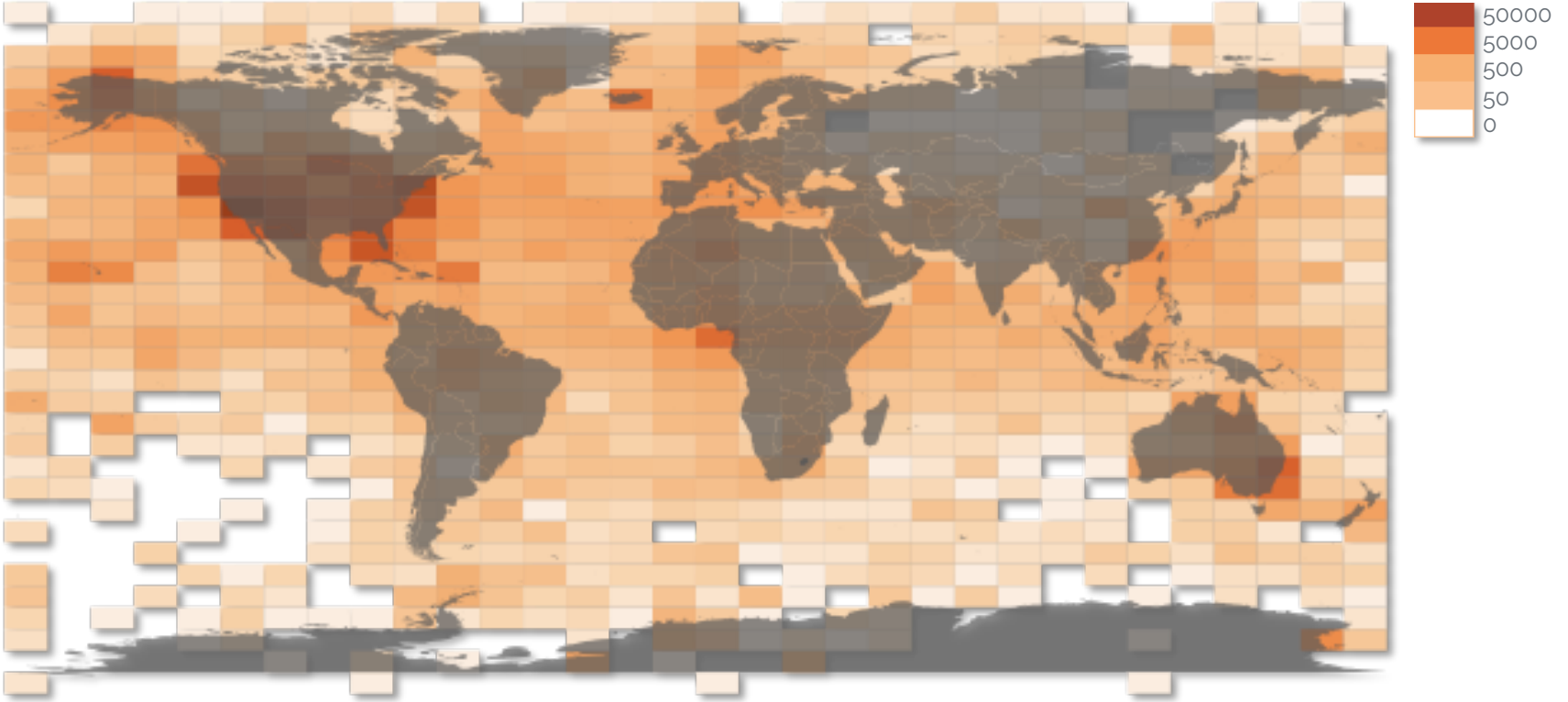
# QUANTIFYING FAIR: AUTOMATED METADATA IMPROVEMENT AND GUIDANCE IN THE DATAONE REPOSITORY NETWORK

Matthew B. Jones, Peter Slaughter, Ted Habermann

0000-0003-0077-4738
@metamattj

*Implementing FAIR Data for People and Machines: Impacts and Implications, Sep 11, 2019*




Global Data Coverage

DataONE

Repository Federation

Global

Interoperable

Community

# DataONE Metrics

**Global**
Data Coverage

**806K**
Data Packages

**40** Webinars

**10**
Education Modules

**42**
Member Repos

**152K**
Contributors

**19,600**
Users/Month

**5300+**
Trained

# MetaDIG: Metadata Improvement and Guidance

## Metadata Quality Report

After running your metadata against our standard set of metadata, data, and congruency checks, we have found the following potential issues. Please assist us in improving the discoverability and reusability of your research data by addressing the issues below.

**Quality suite:** DataONE Metadata Completeness Suite v1.0


**Identification**: 88% complete

**Discovery**: 100% complete

**Interpretation**: 100% complete

- **Passed 14 checks out of 20 (informational checks not included).**
- **Warning for 5 checks. Please review these warnings.**
- **Failed 1 check. Please correct these issues.**

More than one license was found which was an unexpected state. identification REQUIRED FAILURE

NCEAS

The HDF Group

## Findable

Metadata and data should be easy to find for both humans and computers. Machine-readable metadata are essential for automatic discovery of datasets and services.

## Accessible

Once the user finds the required data, she/he needs to know how can they be accessed, possibly including authentication and authorisation.

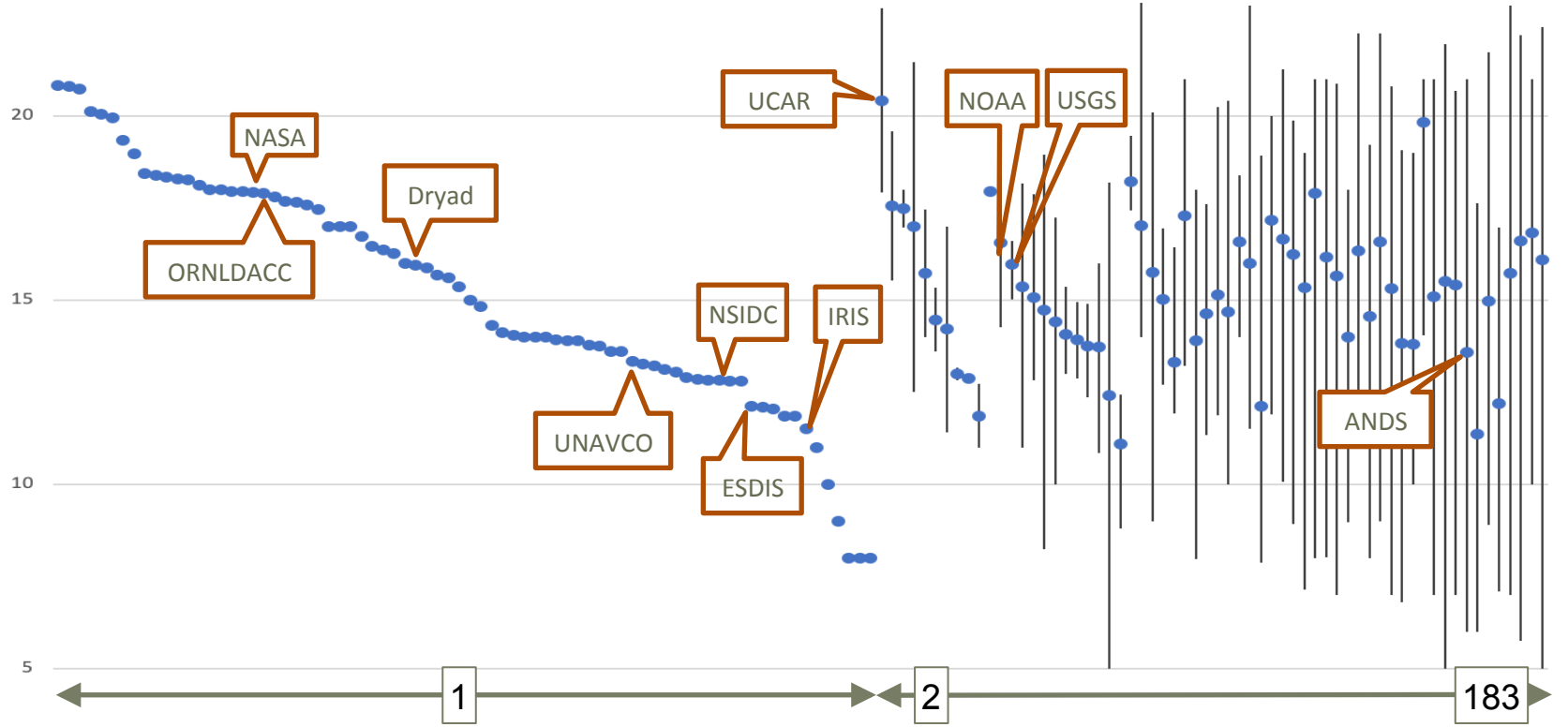
## Interoperable

The data usually need to be integrated with other data. In addition, the data need to interoperate with applications or workflows for analysis, storage, and processing.

## Reusable

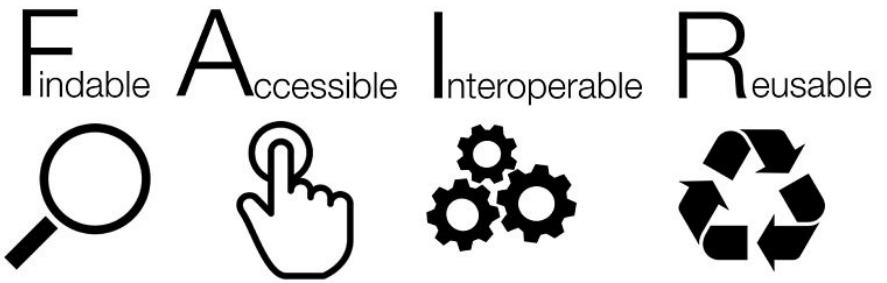
The ultimate goal of FAIR is to optimise the reuse of data. Metadata and data should be well-described so they can be replicated and combined in different settings.

# **FAIR Measure** – DataCite Providers




Slide credit: Ted Habermann

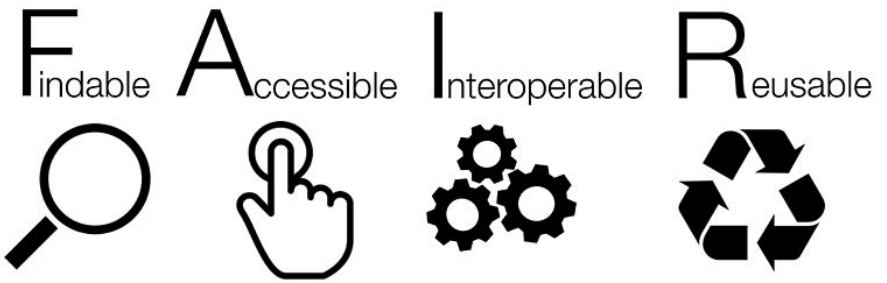
Number of Clients




“A diverse set of stakeholders—representing academia, industry, funding agencies, and scholarly publishers—have come together to design and jointly endorse a **concise and measurable** set of principles that we refer to as the FAIR Data Principles.” Wilkinson et al., 2016

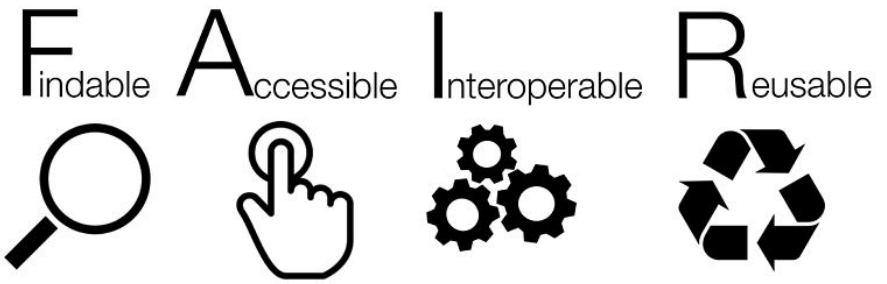
F2. Data are described with **rich metadata** (defined by R1 below)

R1. Meta(data) are richly described with a **plurality** of accurate and relevant attributes
R1.1. (Meta)data are released with a **clear** and accessible data usage license
R1.2. (Meta)data are associated with **detailed** provenance
R1.3. (Meta)data meet **domain-relevant** community standards




Binary?

Yes or No?
True or False?




# Continuum

Findable

Accessible

Interoperable

Reusable

# FAIR metrics,
# a community process

Wilkinson 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

# FAIR Metrics workshop March 2019

- Deep dive into metadata concepts
  - Ecological Metadata Language
  - ISO 19115*
  - DataCite metadata

# FAIR Metrics session, July 2019

- Community consensus via Documentation cluster
- Discussed > 90 FAIR checks
- Implemented 52 checks

- https://github.com/NCEAS/metadig-checks/

Findable

# DataONE FAIR Checks

DataONE

## 17 Checks

| Item that is checked | Description of check | Facet | Required | Implemented |
|---|---|---|---|---|
| title | presence, length, content | F2 | Y | partially |
| metadata identifier | presence, globally unique, id type | F1 | Y | partially |
| resource identifier | presence, globally unique, id type | F3 | Y | partially |
| resource identifier type | presence | F3 | Y | Y |
| publication date | presence | F2 | Y | Y |
| abstract | presence, length, content | F2 | Y | partially |
| award # or funder | presence | F2 | N | Y |
| temporal coverage | presence | F2 | N | Y |

Accessible

# DataONE FAIR Checks

DataONE

## 10 Checks

| Item that is checked | Description of check | Facet | Required | Implemented |
|---|---|---|---|---|
| publisher | presence, significant name, is it an organization id? | A1 | Y | partially |
| distributor | presence, significant name, is it an organization id? | A1 | Y | partially |
| identifier | retrievable | A1 | Y | N |
| resource distribution URL for landing page | presence, retrievable, protocol type | A1 | Y | partially |
| service data url | presence, retrievable, protocol type | A1 | Y | N |

Interoperable

# DataONE FAIR Checks

DataONE

## 12 Checks

| Item that is checked | Description of check | Facet | Required | Implemented |
|---|---|---|---|---|
| metadata schema | the metadata document is schema valid | I1 | Y | N |
| data format | presence, data in non-proprietary format | I1 | Y | partially |
| checksum | presence, checksum matches data | | Y | partially |
| attribute definition | presence | I2 | Y | Y |
| attribute names unique | for an entity, names are unique | I2 | Y | N |
| attribute storage type | presence | I2 | Y | Y |

Reusable

# DataONE FAIR Checks

DataONE

## 13 Checks

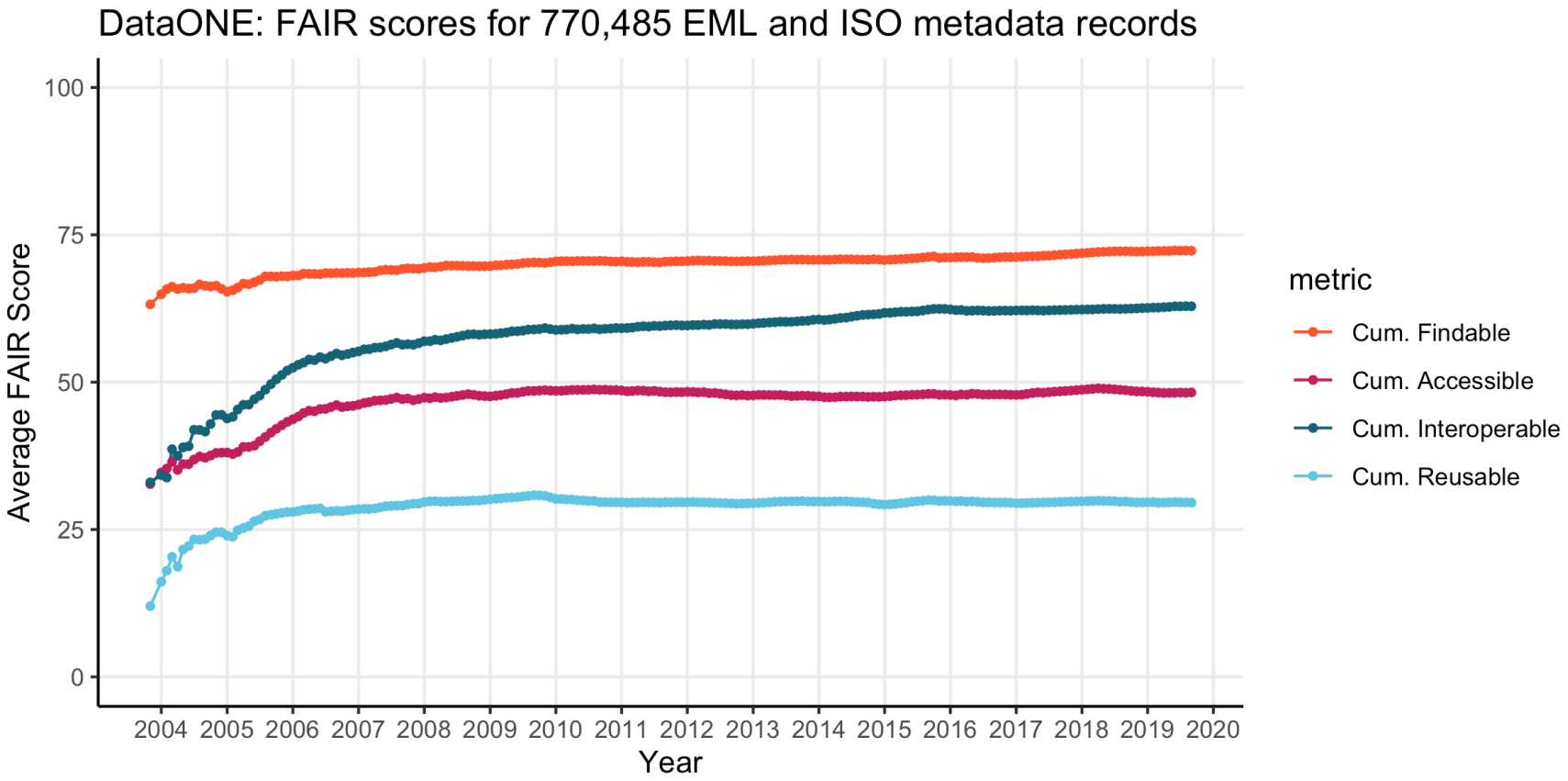
| Item that is checked | Description of check | Facet | Required | Implemented |
|---|---|---|---|---|
| metadata license | presence | R1.1 | Y | Y |
| data license | presence | R1.1 | Y | Y |
| resource description | presence | | Y | Y |
| methods description | presence | | Y | Y |
| attribute units | presence, controlled vocabulary | R1.3 | Y | partially |
| attribute domain | presence, congruence | R1.3 | Y | partially |
| attribute measurement scale | presence | R1.3 | Y | Y |

# Are datasets in DataONE FAIR?
# Preliminary results

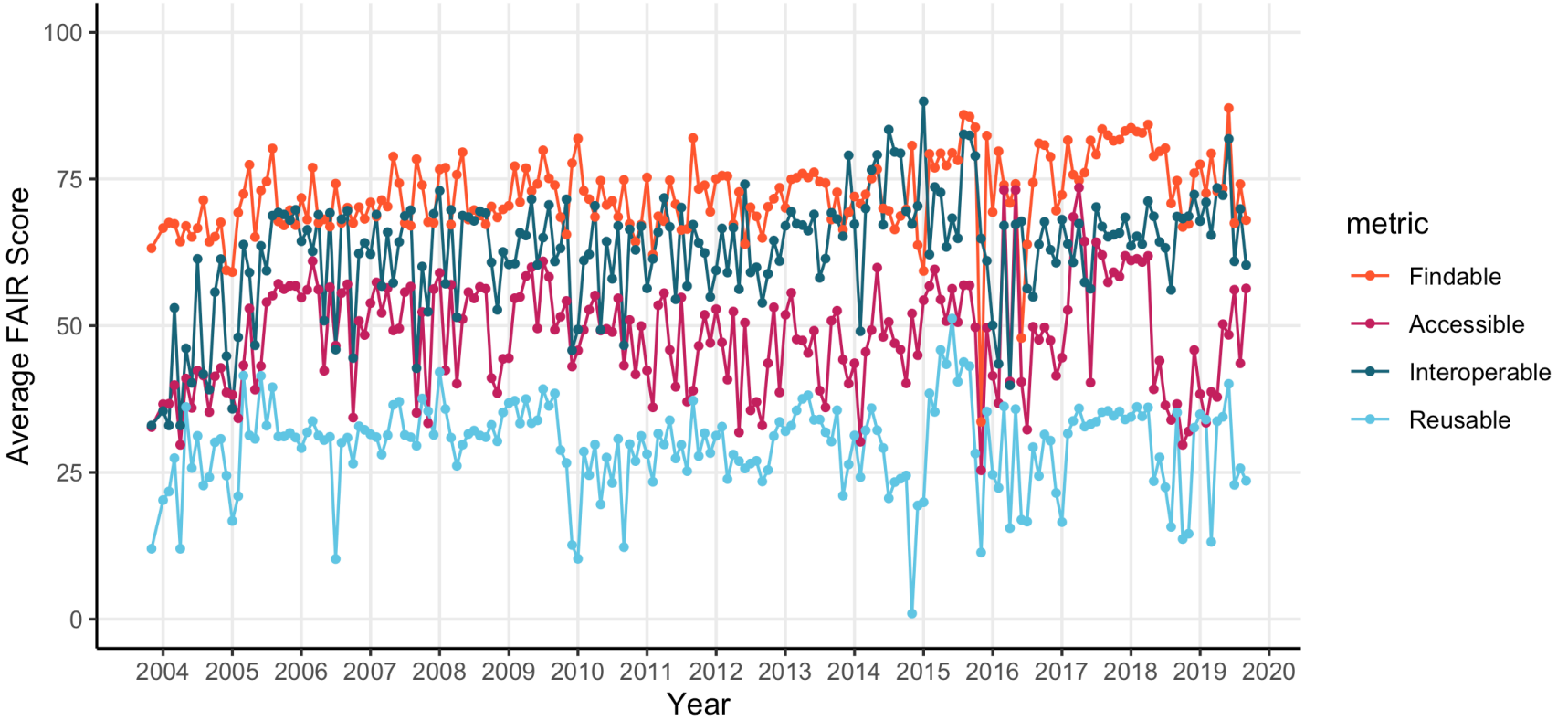
*Data set citation:*

Matthew Jones, Peter Slaughter, and Ted Habermann. 2019. Quantifying FAIR: metadata improvement and guidance in the DataONE repository network. KNB Data Repository. doi:10.5063/F14T6GP0.

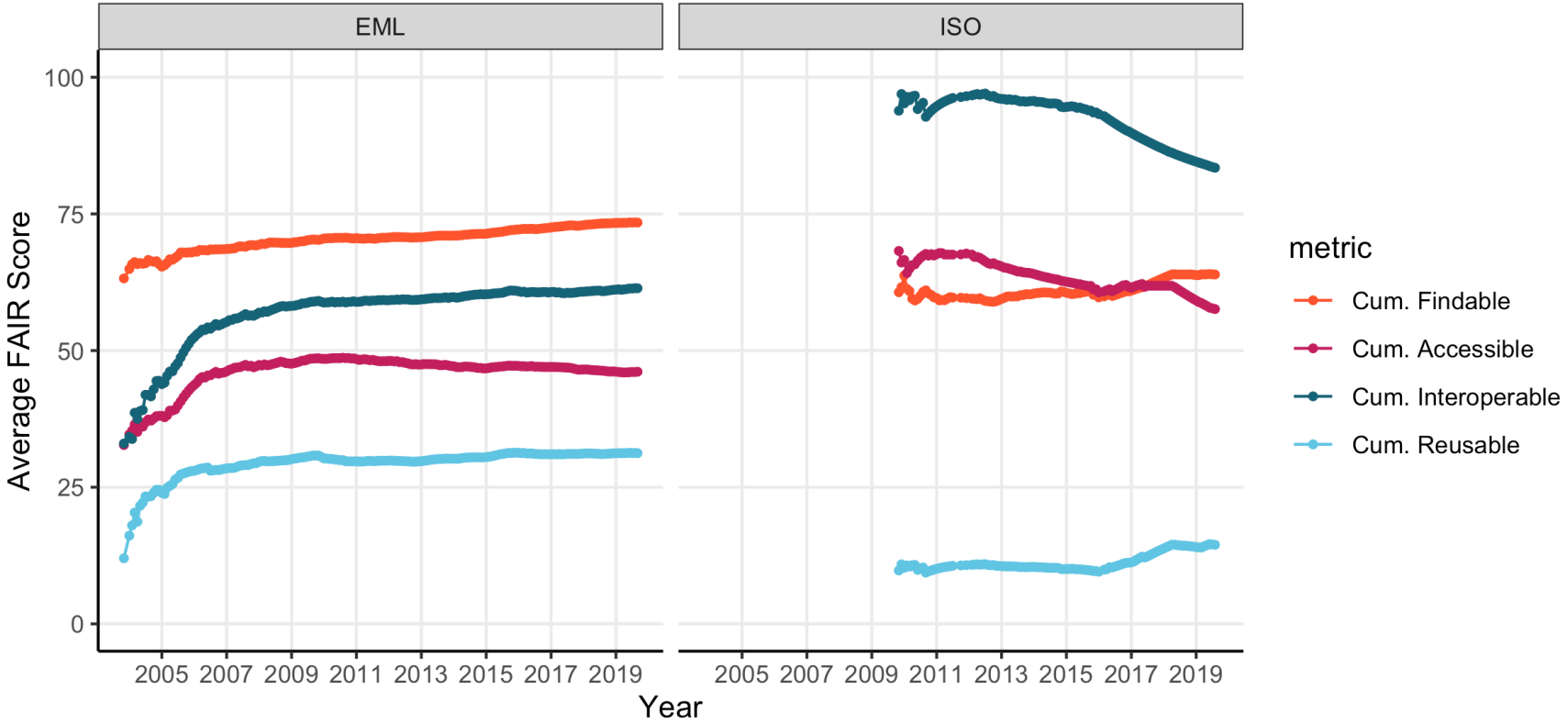

DataONE
About
News
Participate
Resources
Education
Data
DATAONE SEARCH:
Search
Summary
Jump to:
DOI or ID
Go


DataONE: FAIR scores for 770,485 EML and ISO metadata records
Average FAIR Score
100
75
50
25
0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Year
metric
Cum. Findable
Cum. Accessible
Cum. Interoperable
Cum. Reusable

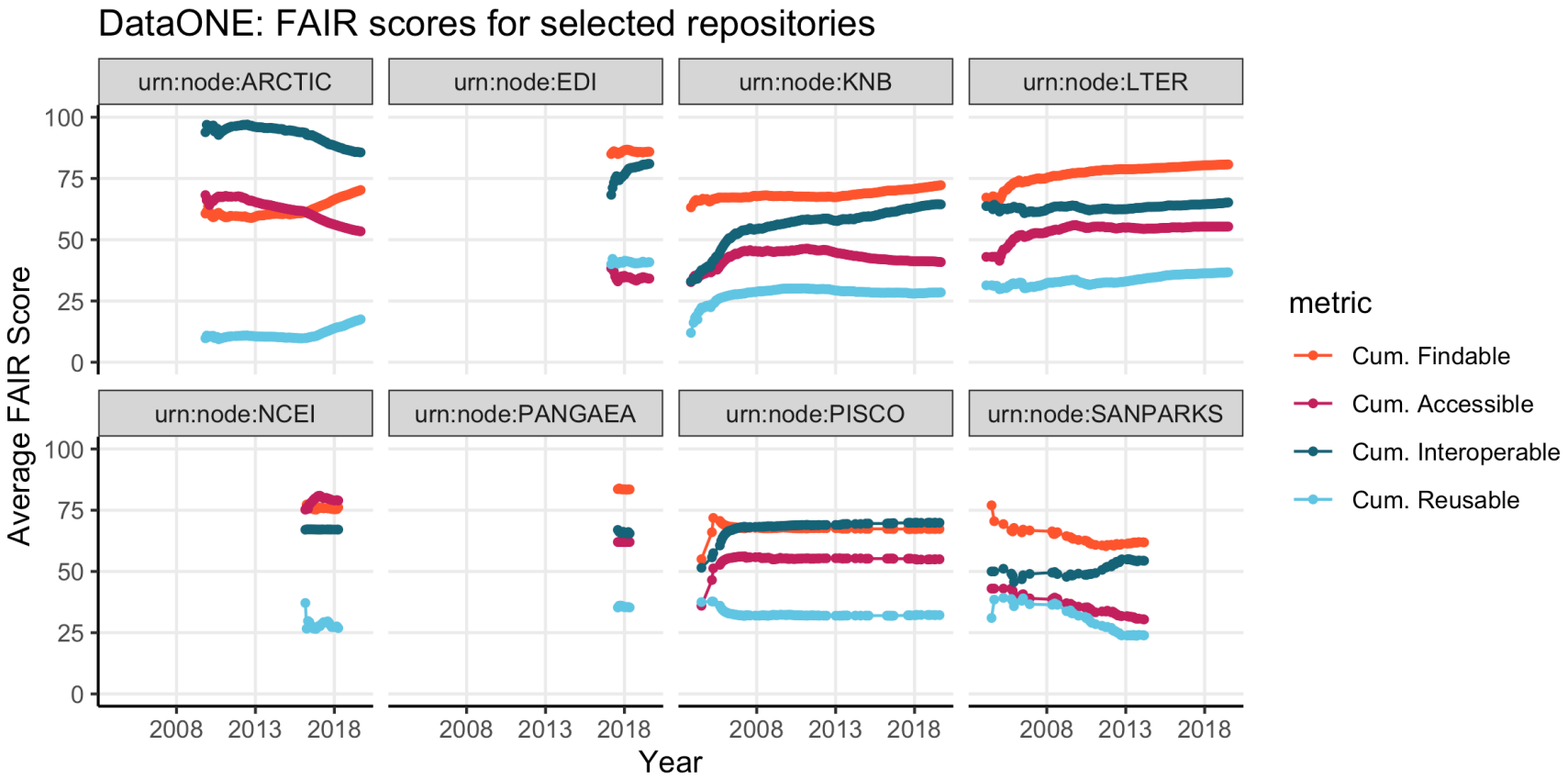

DataONE: FAIR scores for 770,485 EML and ISO metadata records




DataONE: FAIR scores for 195,725 EML and 574,760 ISO metadata records

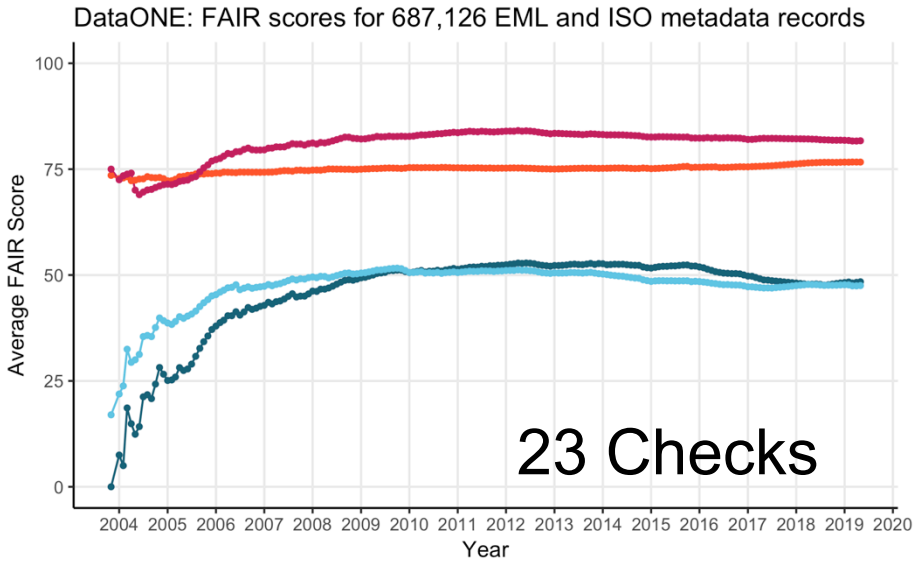


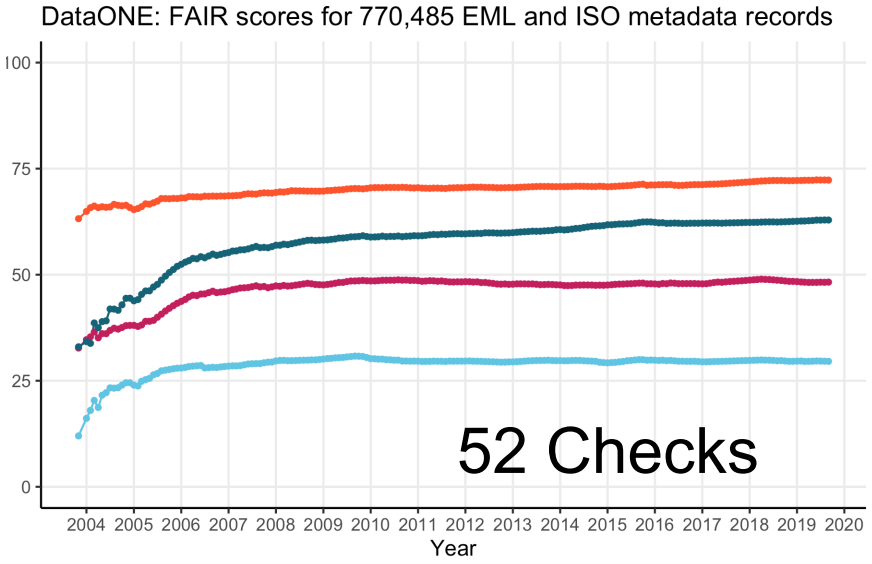

DataONE
About
News
Participate
Resources
Education
Data
DATAONE SEARCH:
Search
Summary
Jump to:
DOI or ID
Go


DataONE: FAIR scores for selected repositories
urn:node:ARCTIC
urn:node:EDI
urn:node:KNB
urn:node:LTER
urn:node:NCEI
urn:node:PANGAEA
urn:node:PISCO
urn:node:SANPARKS
Average FAIR Score
100
75
50
25
0
2008
2013
2018
Year
metric
Cum. Findable
Cum. Accessible
Cum. Interoperable
Cum. Reusable

# Why Community Consensus?

**Because we become what we measure.**




Cum. Findable
Cum. Accessible
Cum. Interoperable
Cum. Reusable

www.nature.com/scientificdata

SCIENTIFIC DATA

OPEN

# Comment: A design framework and exemplar metrics for FAIRness

Mark D. Wilkinson[1], Susanna-Assunta Sansone[2], Erik Schultes[3], Peter Doorn[4], Luiz Olavo Bonino da Silva Santos[5,6] & Michel Dumontier[7]

- Clear
- Realistic
- Discriminating
- Measurable
- Universal

https://doi.org/10.1038/sdata.2018.118

# Modeling the FAIR Rubrics Landscape

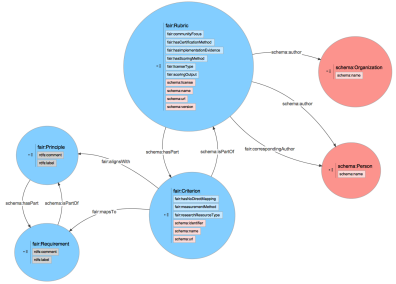
https://osf.io/685sw/

*RDAP Summit*
*2019.05.15-2019.05.17*
*Coral Gables, FL*

Marijane White[1], Lily Winfree[2], Payal Mehndiratta[3], Kimberly Robasky[3,4,5], Robin Champieux[1]

[1]Library, Oregon Health & Science University, Portland, OR; [2]Open Knowledge International; [3]Rennaissance Computing Institute, [4]Department of Genetics, [5]School of Library and Information Science, University of North Carolina, Chapel Hill, NC

**Figure 1: Semantic Data Model**



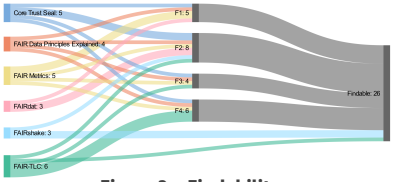



**Figure 2a: Findability**

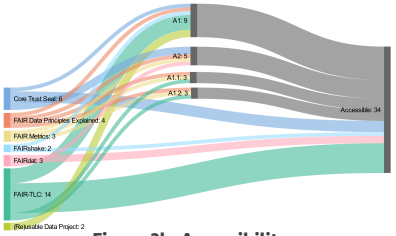



**Figure 2b: Accessibility**


## What

The FAIR Data Principles[1] are the gold standard for evaluating the management and sharing of data and research resources. Many parallel efforts have emerged to identify recommended practices and metrics to help researchers and institutions improve and measure the FAIRness of their sharing efforts.

In this work, we conducted an exploratory evaluation of seven rubrics that interpret the FAIR Data Principles and how to meet them:

a) Core Trust Seal[2]
b) FAIR Data Principles Explained[3]
c) FAIR Metrics[4]
d) FAIRdat[5]
e) FAIRshake[6]
f) FAIR-TLC[7]
g) (Re)usable Data Project[8]

Collectively, the rubrics have 167 criteria that either align with the Principles or map directly to their requirements. Some criteria align with or map to more than one Principle or requirement, and nine criteria do not align with or map to any of them.

## Why

The FAIR principles are good but they can be difficult to interpret. The principles themselves do not articulate specific practices or actions, but there is a growing body of rubrics that give specific recommendations and guidelines for adhering to the principles. We wanted to understand and help people act upon the different ways

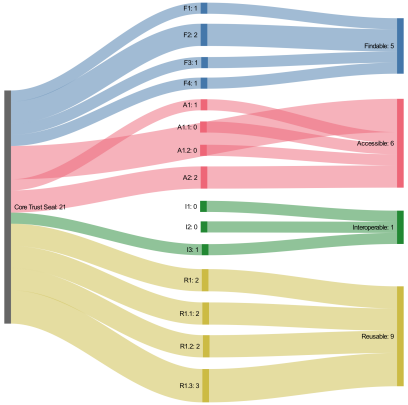



**Figure 3a: Core Trust Seal**

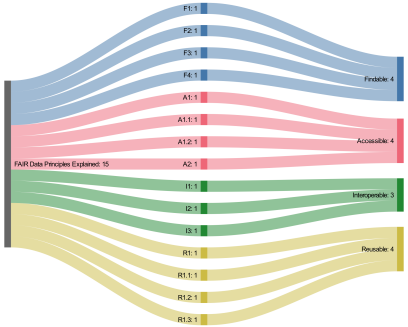



**Figure 3b: FAIR Data Principles Explained**

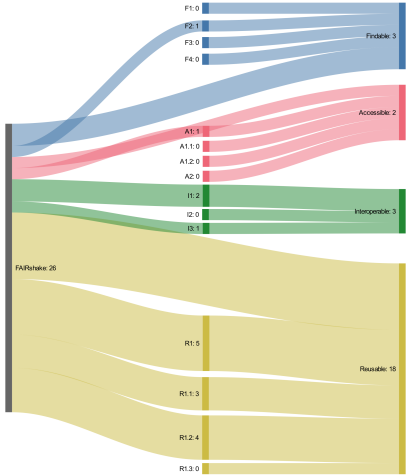
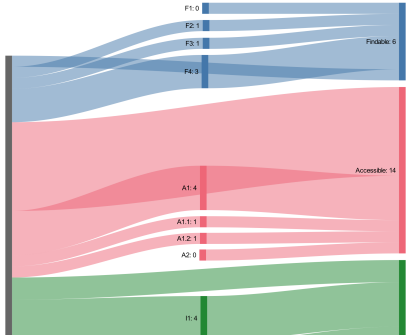



**Figure 3e: FAIRshake**



FAIR is concise

FAIR is ambiguously measurable

FAIR is a continuum

We need community consensus

We will become what we measure

# Big thanks to our collaborators:

Ted Habermann
Sean Gordon
Margaret O'Brien
Bryce Mecum
Amber Budden
Dave Vieglais
and
the DataONE Team

MetaDIG: 1443062
Arctic Data Center: 1546024
DataONE: 1430508