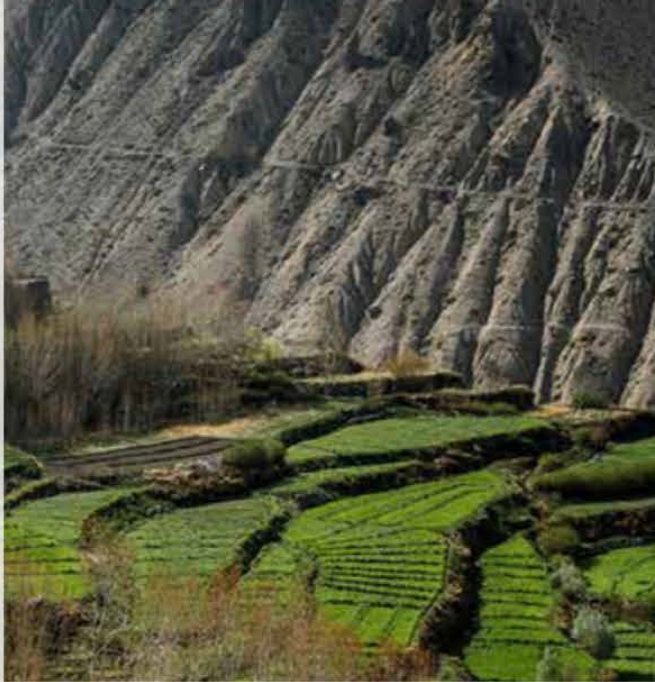


EMBEDDING ECOSYSTEM SERVICES INTO POLICY LEARNING SERIES

Session 2: Collaborative and Interoperable Open Science



about our workshop

Integrated, easily manipulable and collaborative data is important to ensure equity in NCA practices. It also goes a long way in linking the work of the global NCA community with minimal effort. This session explores the idea of interoperability in NCA, suggests a shared vision for NCA, and does a deep dive into the ARIES and SEEA tools for the advancement of interoperability in NCA.

Keywords: Interoperability, Semantics, Models, ARIES, SEEA

learning objectives

- Understand the role of interoperability in advancing open science for natural capital accounting.
- Learn how to access the ARIES for SEEA tool for compilation of natural capital accounts, and where to find further resources to use it..



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Kenneth Bagstad is a Research Economist working with the U.S. Geological Survey's Geosciences and Environmental Change Science Center. Since 2016, he has co-lead the development of pilot natural capital accounts in the United States. He also assisted in the development of natural capital accounts in Colombia, Costa Rica, the Philippines, and Rwanda as part of the World Bank's WAVES Program. Ken has been a member of the Artificial Intelligence for Environment and Sustainability (ARIES) team since 2007 and since 2020 has collaborated with the U.N. in developing the ARIES for SEEA platform.

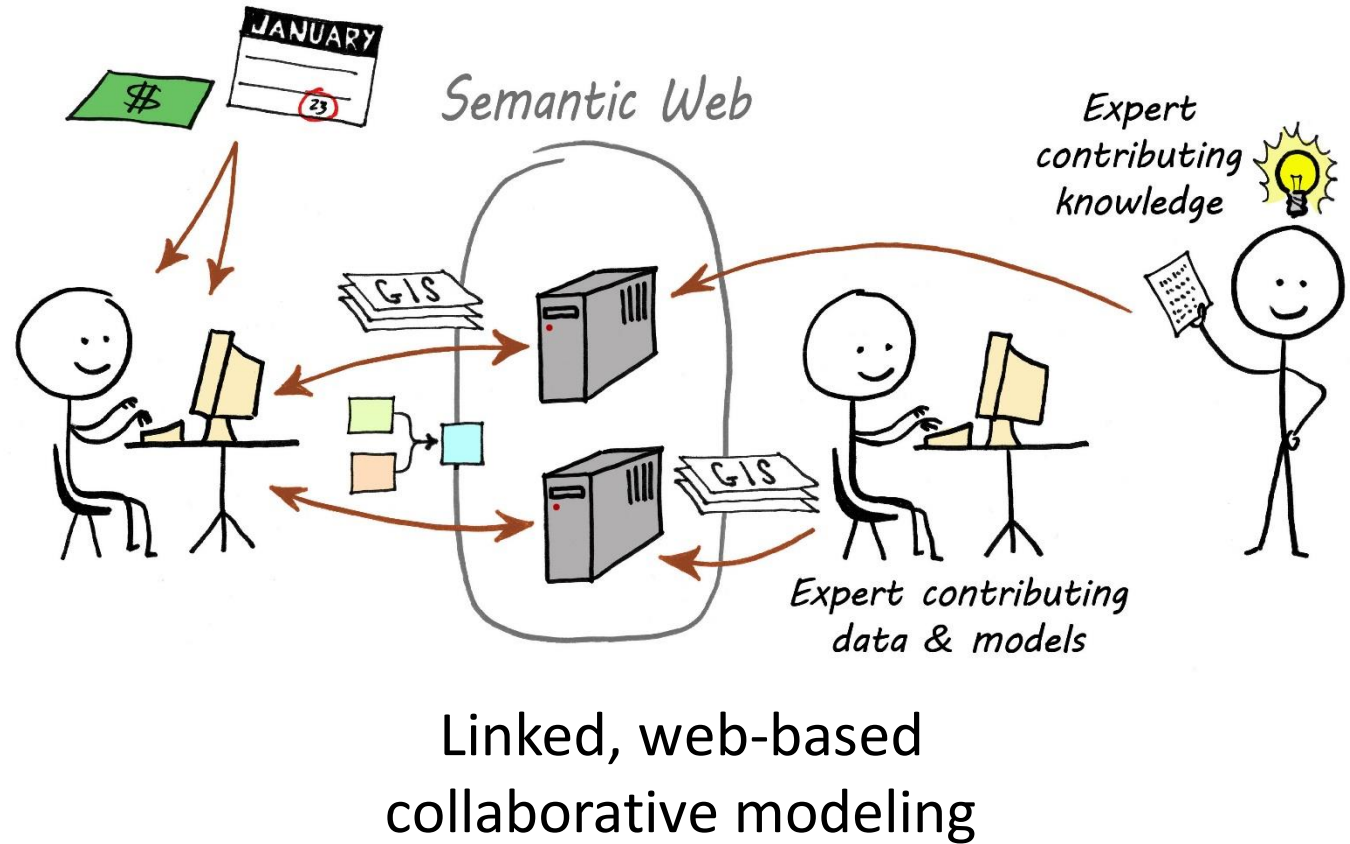
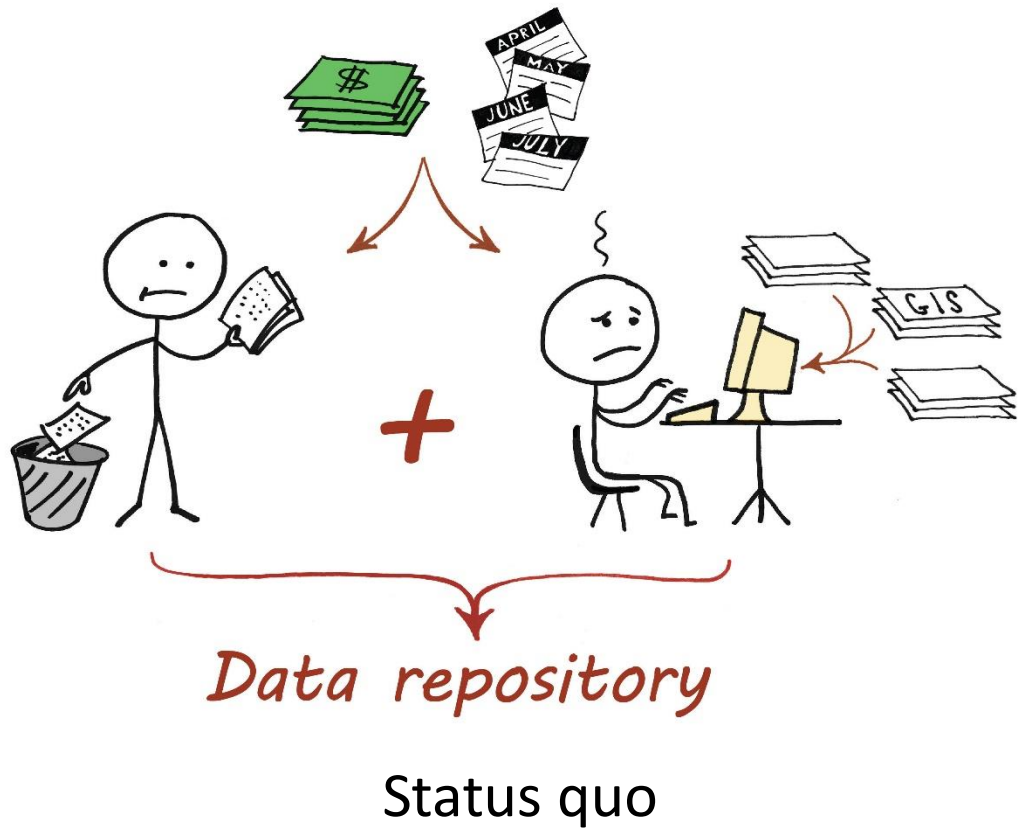


Collaborative & interoperable science for ecosystem services & natural capital accounting

June 2022

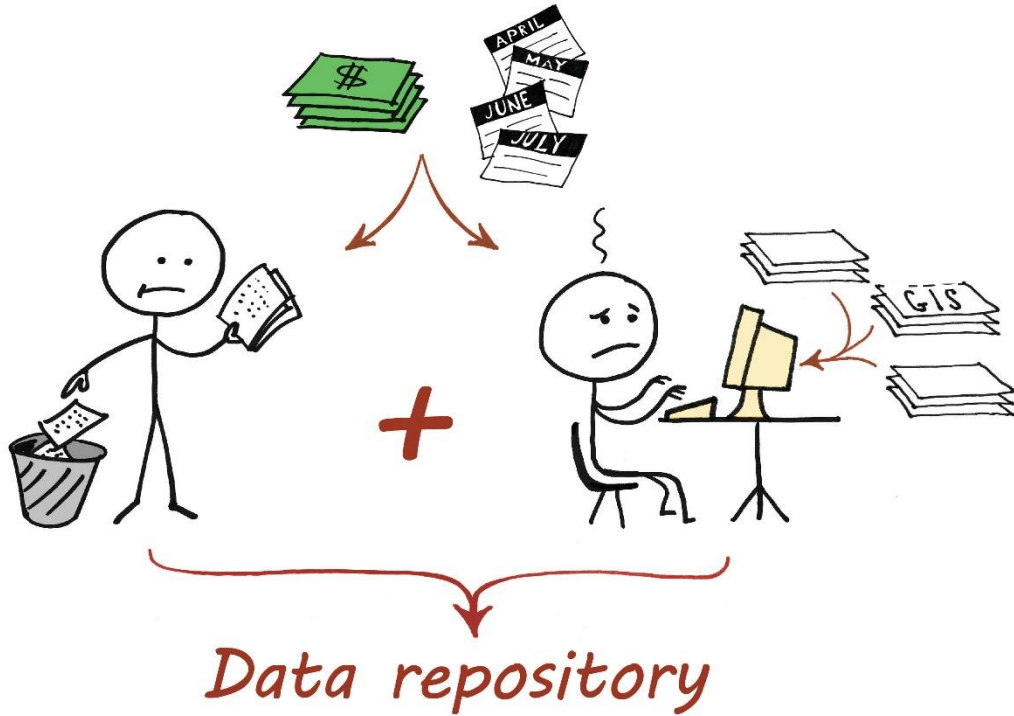
Ken Bagstad, Ferdinando Villa, Stefano Balbi, Alessio Bulckaen & the ARIES, UNSD, & UNEP Team

Toward faster, better modeling

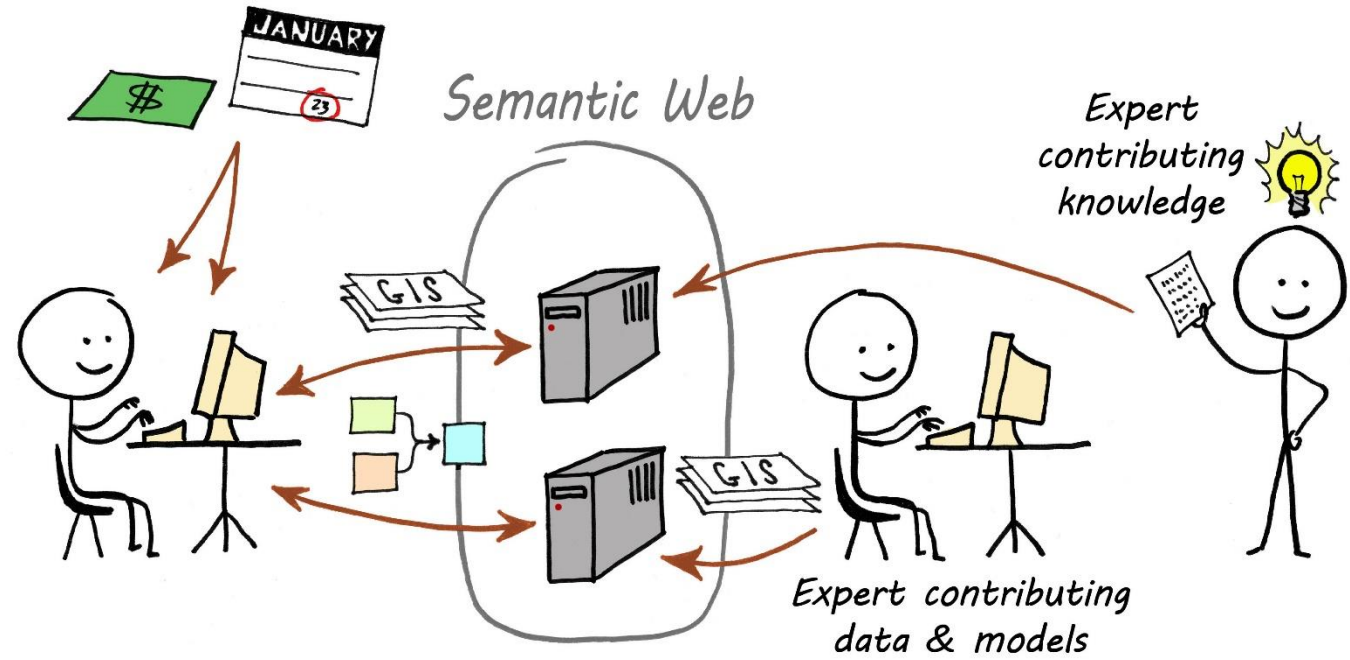


Practical example: Sediment retention accounting

Revised Universal Soil Loss Equation (RUSLE): commonly used in InVEST, LUCI, ARIES, and one-off modeling applications



Status quo



Semantic interoperability in ARIES for SEEA

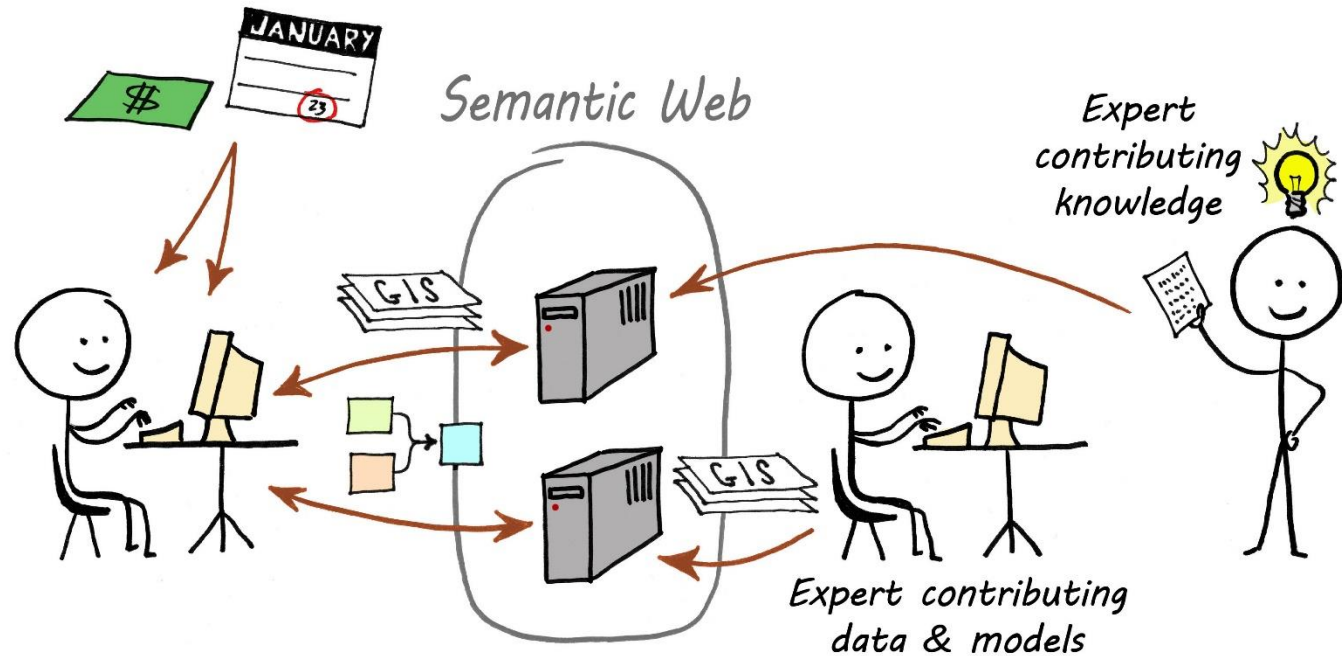
Given the urgency of scaling up NCA, interoperability is a powerful tool to do so *as a community*

Who benefits?

An ecosystem accounts compiler at a NSO

A member of an indigenous community or urban environmental justice group

A small NGO or local government



Interoperability:

The ability of independently developed data or tools to integrate or work together with minimal effort

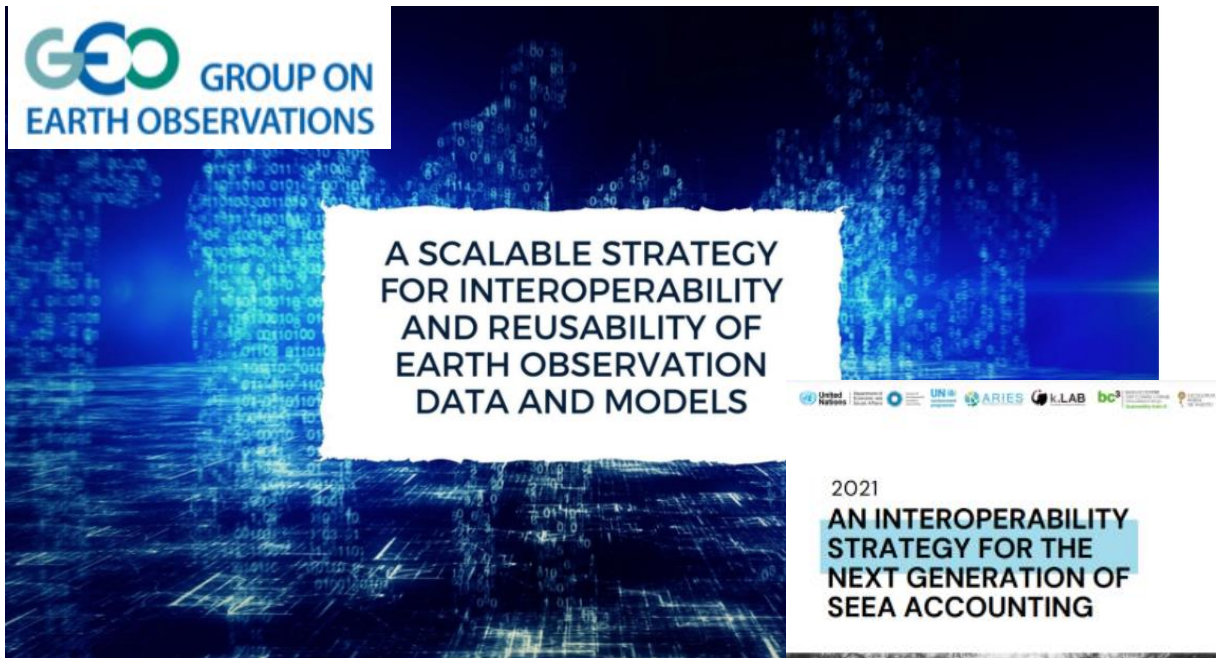
A core challenge to the global NCA community

Interoperability can address serious equity issues

- Scientists from the Global North **can do great (& painstaking) one-off studies**
- **Diffusion of best scientific practices** is time-consuming & requires great expertise
- Capacity development in the Global South **remains very time consuming**
- A fundamental equity issue: Global North experts are at a huge advantage.
How do we maximize the opportunity for junior NSO employees tasked with developing their nation's first SEEA EA accounts to succeed?

Before we worry about choosing a model, we need to choose a vision for the future of NCA implementation

Interoperability *must address the human element:* User-friendly, equitable, community endorsed



https://www.earthobservations.org/geo_blog_obs.php?id=527



<https://www.data4sdgs.org/news/why-people-are-essential-data-interoperability>

A shared vision?

SEEA accounts & related indicators will be:

1. rapidly recompilable as new science emerges,
2. quickly produced to show the most recent trends as new annual data become available, with
3. robust international comparisons possible from common global data, while country-specific customization is still easily done.

This vision moves high-quality, meaningful **information from scientists into the hands of decision makers**, the public, and the media as quickly as possible.

2021

AN INTEROPERABILITY STRATEGY FOR THE NEXT GENERATION OF SEEA ACCOUNTING



ARIES & other tools

- Ecosystem service modeling toolkits (InVEST, ESTIMAP, LUCI, ENSYM/Data4Nature): provide a set of models, one for each ES
- Data viewers (UN Biodiversity Lab): Visualize & summarize data in interactive, attractive settings
- Cloud computing platforms (Google Earth Engine, Microsoft Planetary Computer): Run large-scale computations on the cloud
- Model integration frameworks (CSMDS, VLab, OpenGMS): Highly technical tools for model coupling, usually using syntactic interoperability

ARIES: Assemble & use (with AI support) collective knowledge of the scientific community to make it easier to implement SEEA globally

How can NSOs use ARIES for SEEA?

1. Determine which methods a NSO wants to use for NCA
2. Catalog available national data & models; determine which can be made public and which are restricted
3. Make needed data & models interoperable with ARIES, placing in public or private projects as appropriate
4. Test & validate models
5. Produce accounts using ARIES for SEEA
 - Revisit underlying data & methods as improved approaches become available

Support of ARIES for SEEA

- Wiki space (accessible with your username & password; register at <https://integratedmodelling.org/hub/>):
<https://confluence.integratedmodelling.org/>
 - Questions: <https://confluence.integratedmodelling.org/questions>
 - Modeling Quick Tips:
<https://confluence.integratedmodelling.org/display/KIM/0.+Getting+started>
- Software support: support@integratedmodelling.org

Support from ARIES team

1. Training materials (video, in-person, remote)
2. Support for data hosting
 1. Pending QGIS plugin for data ingestion
3. Support for semantic annotation of data & models

An Africa NCA CoP vision – By 2027, with a clear focus on interoperability from the global SEEA community, African nations will:

- Produce their own SEEA EA accounts, endorsed by their NSOs and populated with their own data
- Regularly update accounts as new global, regional, and national data become available
- Continually improve the quality of estimates as science continues to evolve
- Lead South-South capacity building around NCA

An Africa NCA CoP vision – By 2040, with an undirected focus on interoperability from the global SEEA community, African nations will:

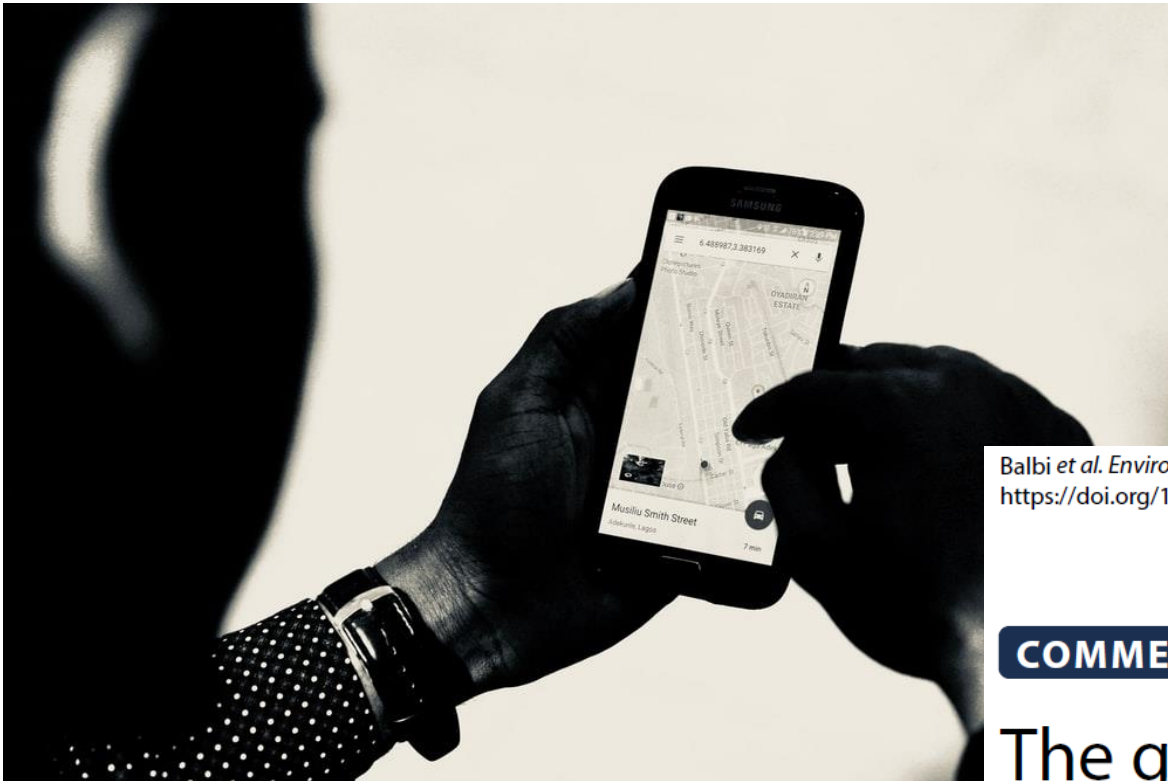
- Produce their own SEEA EA accounts, endorsed by their NSOs and populated with their own data
- Regularly update accounts as new global, regional, and national data become available
- Continually improve the quality of estimates as science continues to evolve
- Lead South-South capacity building around NCA

Do we have a decade or more to waste when mature technology already exists?

Where should we invest our efforts?



Countries should demand more of the global SEEA community: focused collaboration & leadership for interoperability



Balbi et al. *Environmental Evidence* (2022) 11:5
<https://doi.org/10.1186/s13750-022-00258-y>


Environmental Evidence

COMMENTARY

Open Access

The global environmental agenda urgently needs a semantic web of knowledge



Stefano Balbi^{1,2*} , Kenneth J. Bagstad³, Ainhua Magrach^{1,2}, Maria Jose Sanz^{1,2}, Naikoa Aguilar-Amuchastegui⁴, Carlo Giupponi⁵ and Ferdinando Villa^{1,2}

Discussion/Q&A

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Beyond the state of the practice: common goals & standards

Syntactic
interoperability:
Use of compatible data
formats and
communication
protocols.
Low bar, more limited
advantages

>

Semantic
interoperability:
Data transfers where a
receiving system can
understand the meaning of
exchanged data, reusing it
appropriately.
Higher bar, greater
potential for automation &
data/model reuse.

Key building blocks for interoperability



1. SEMANTICS: a flexible, shareable, easy-to-learn **language** to describe scientific observations.

Developed by experts in collaboration with disciplinary scientists – typical scientist/NSO does *not* build these.

Use to accurately describe data & model elements in a consistent, machine-readable way.



2. OPEN, LINKABLE DATA: enabling access & publishing of semantically annotated data.

Put data on the web in machine-accessible formats.

Best practices already exist: no more PDFs of model parameters or zip files of spatial data.



3. OPEN, LINKABLE MODELS: open, accurate, “Wikipedia-like” sharing and linking of models.

Code models in a modular style that facilitates reuse (vs. monoliths).

Build documentation into code for automated reporting.

Specify appropriate conditions for safe reuse of your models.



THE WORLD BANK

Environment, Natural Resources & Blue Economy



GPS

Global Program
on Sustainability

Thank you!

Questions?

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