A background image of a dense forest with mist or fog rising between the trees, creating a soft, ethereal atmosphere. The trees are dark green, and the mist is a pale, hazy white.

ARIES for SEEA for rapid accounts generation

Ken Bagstad, Ferdinando Villa,
Stefano Balbi, Alessio Bulckaen, Alessandra
Alfieri, Bram Edens, Will Speller



United Nations
Statistics Division



UNEP



BASQUE CENTRE
FOR CLIMATE CHANGE
Klima Aldaketa Ikergai
Sustainability, that's it!

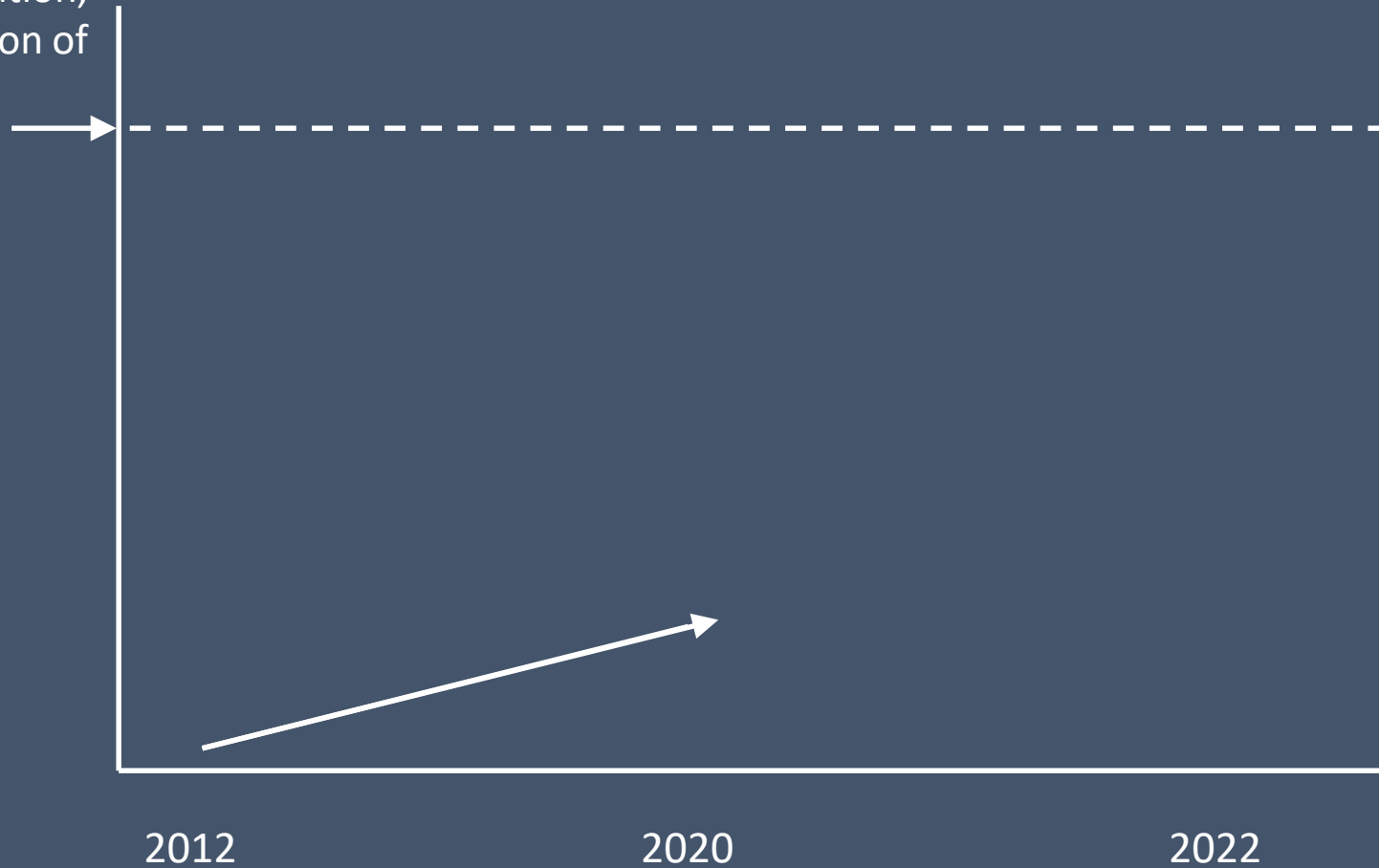


EXCELENCIA
MARÍA
DE MAEZTU



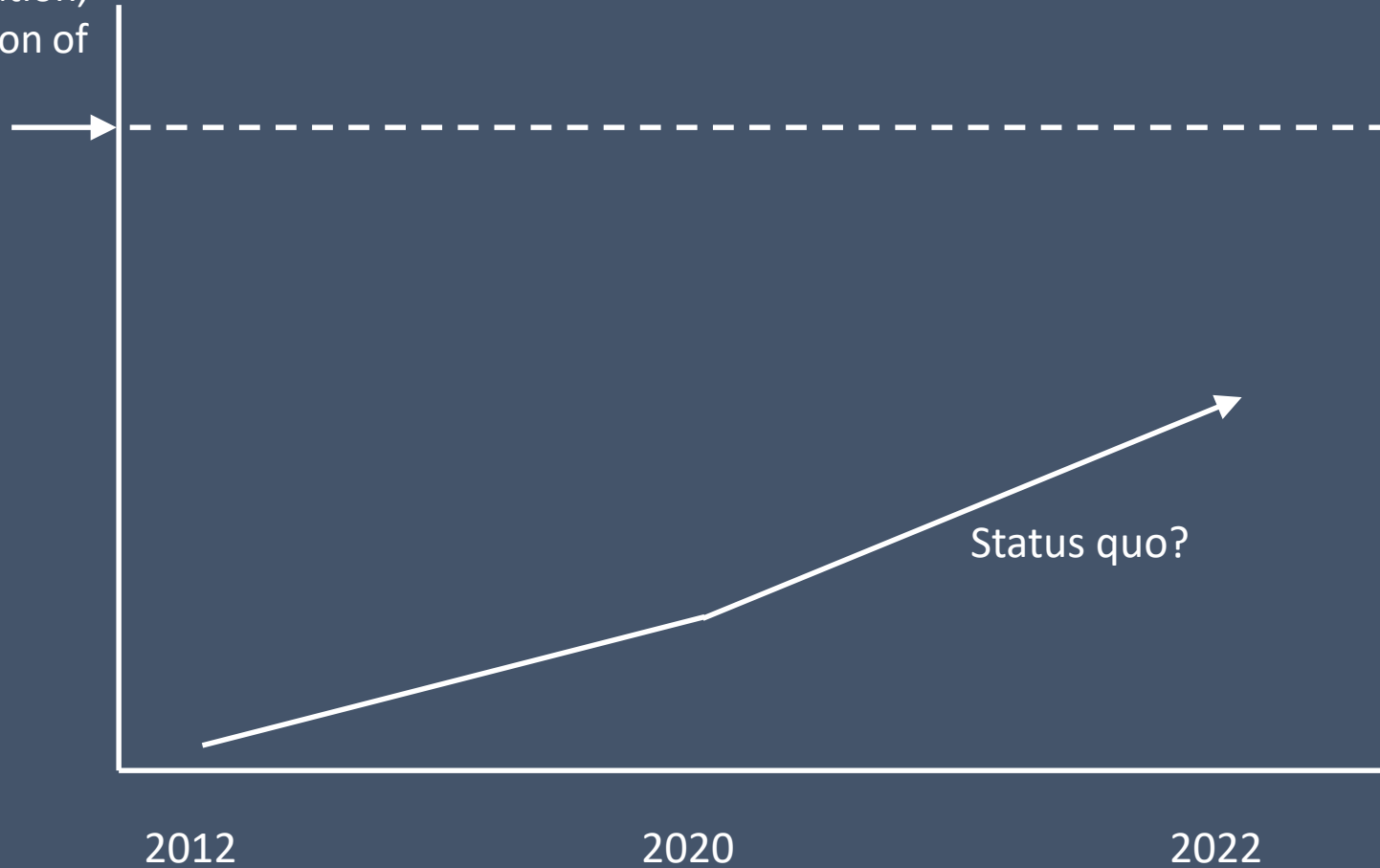
Bending the curve for global ecosystem accounting

Independent compilation,
use, institutionalization of
accounts possible
everywhere



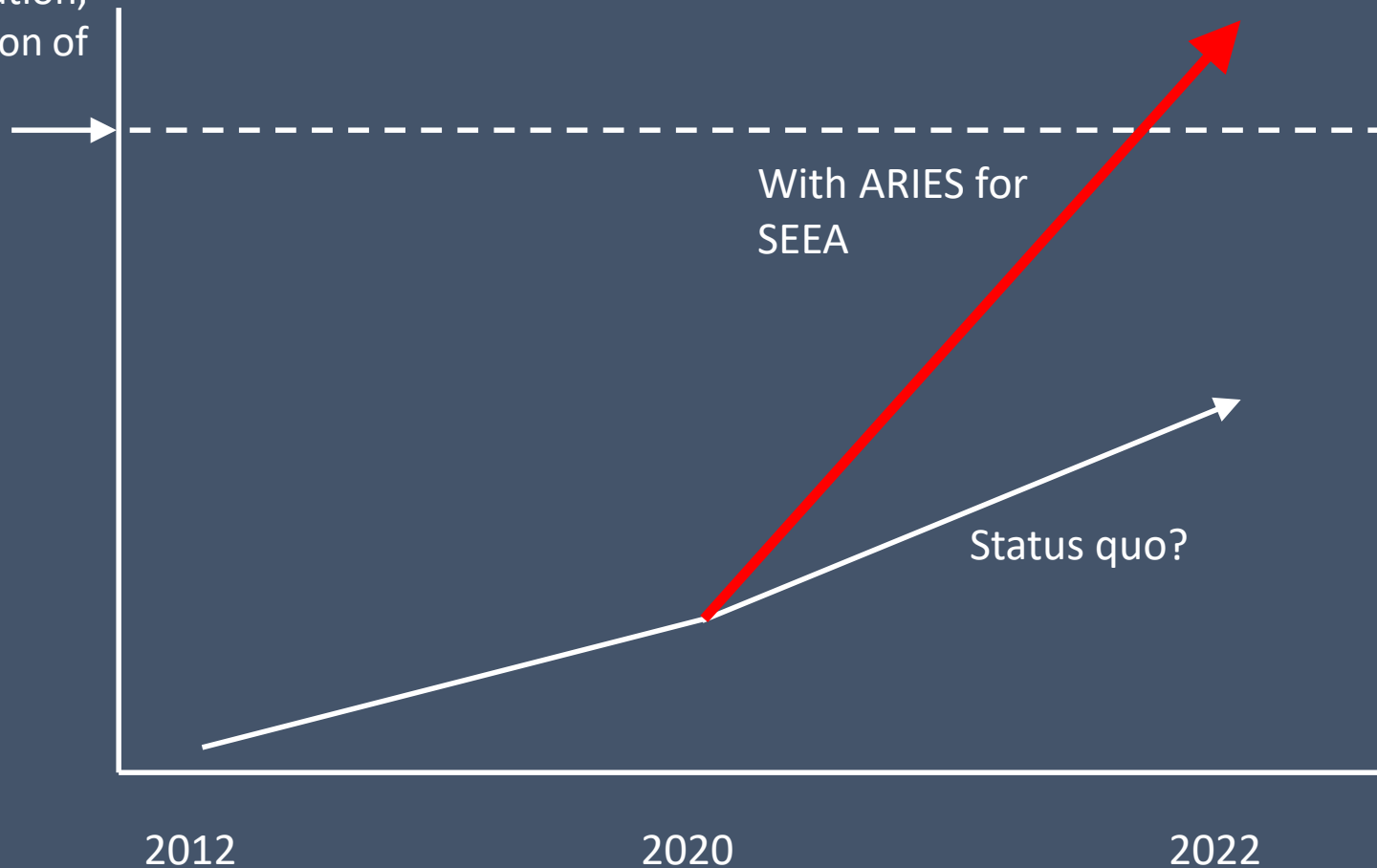
Bending the curve for global ecosystem accounting

Independent compilation,
use, institutionalization of
accounts possible
everywhere

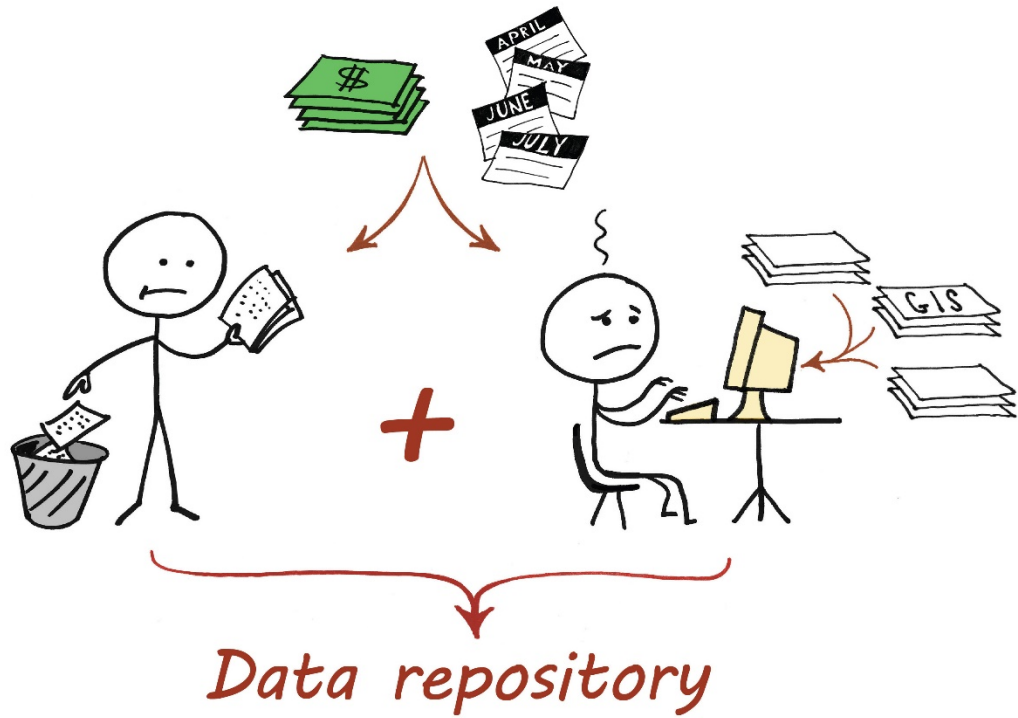


Bending the curve for global ecosystem accounting

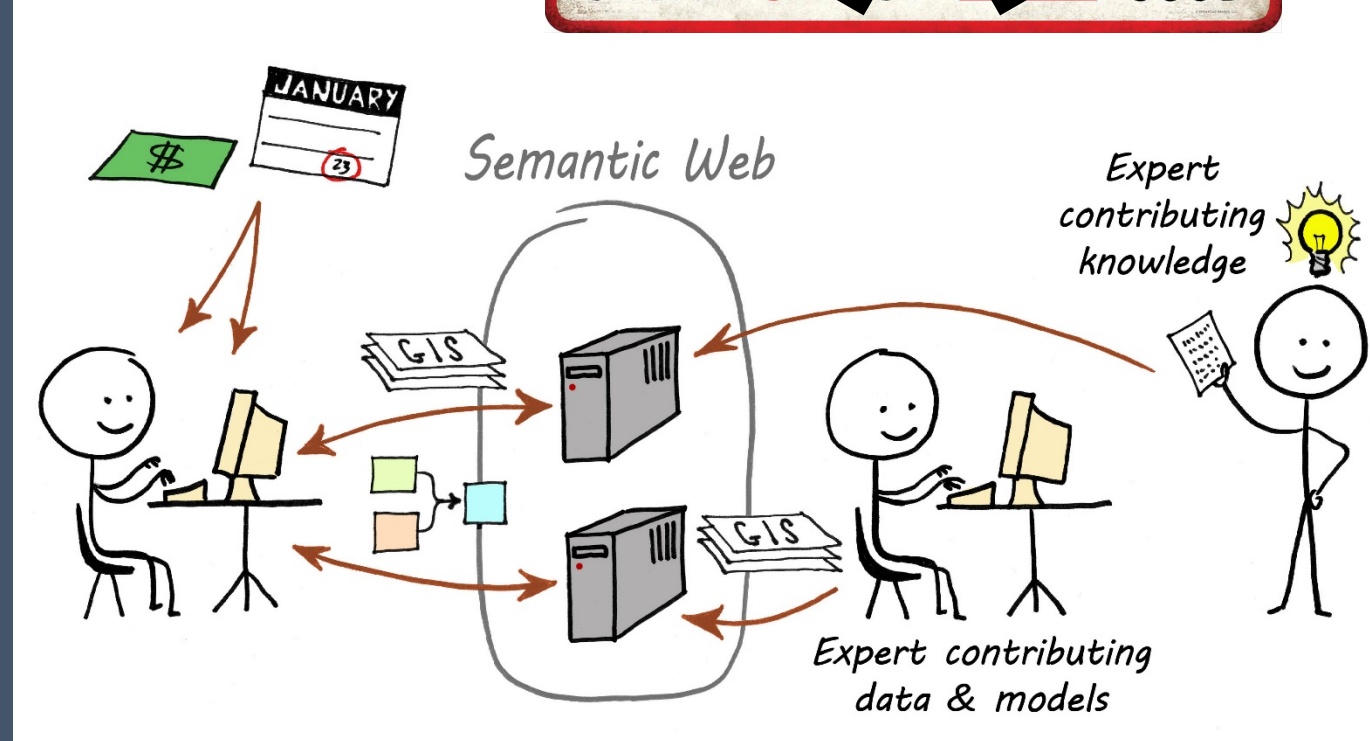
Independent compilation,
use, institutionalization of
accounts possible
everywhere



Does ecosystem accounting always need to be painstakingly slow?



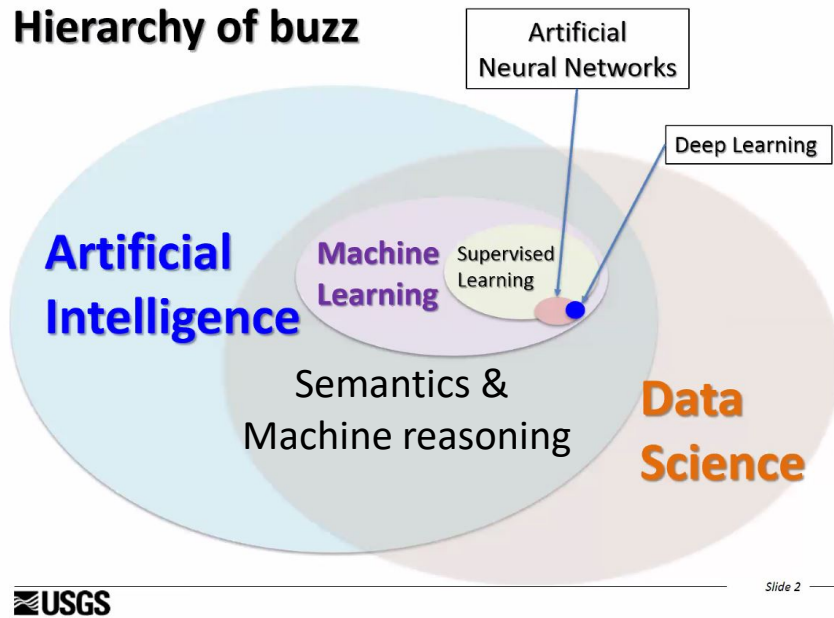
Status quo



Linked, web-based collaborative modeling

Artificial Intelligence for Environment & Sustainability (ARIES)

Hierarchy of buzz



FAIR Principles



Findability

Resource and its metadata are easy to find by both, humans and computer systems. Basic machine readable descriptive metadata allows the discovery of interesting data sets and services.



Accessibility

Resource and metadata are stored for the long term such that they can be easily accessed and downloaded or locally used by humans and ideally also machines using standard communication protocols.



Interoperability

Metadata should be ready to be exchanged, interpreted and combined in a (semi)automated way with other data sets by humans as well as computer systems.



Reusability

Data and metadata are sufficiently well-described to allow data to be reused in future research, allowing for integration with other compatible data sources. Proper citation must be facilitated, and the conditions under which the data can be used should be clear to machines

CGIAR

Reasoning algorithms

+

Decision rules

+

Multidisciplinary semantics

+

Open data & models

+

Open-source software

=

Fast, FAIR multidisciplinary modeling

ARIES for SEEA

for rapid, standardized account creation

- *Global, customizable models approach* enables SEEA EA compilation anywhere & improvement with local data where available
 - Faster & easier to learn than other biophysical modeling approaches
- Automate production of maps & accounting tables for all accounts
- Support adoption of SEEA EA as statistical standard by providing a *consistent, easy-to-use application enabling ecosystem accounting anywhere on Earth*



United Nations
Statistics Division

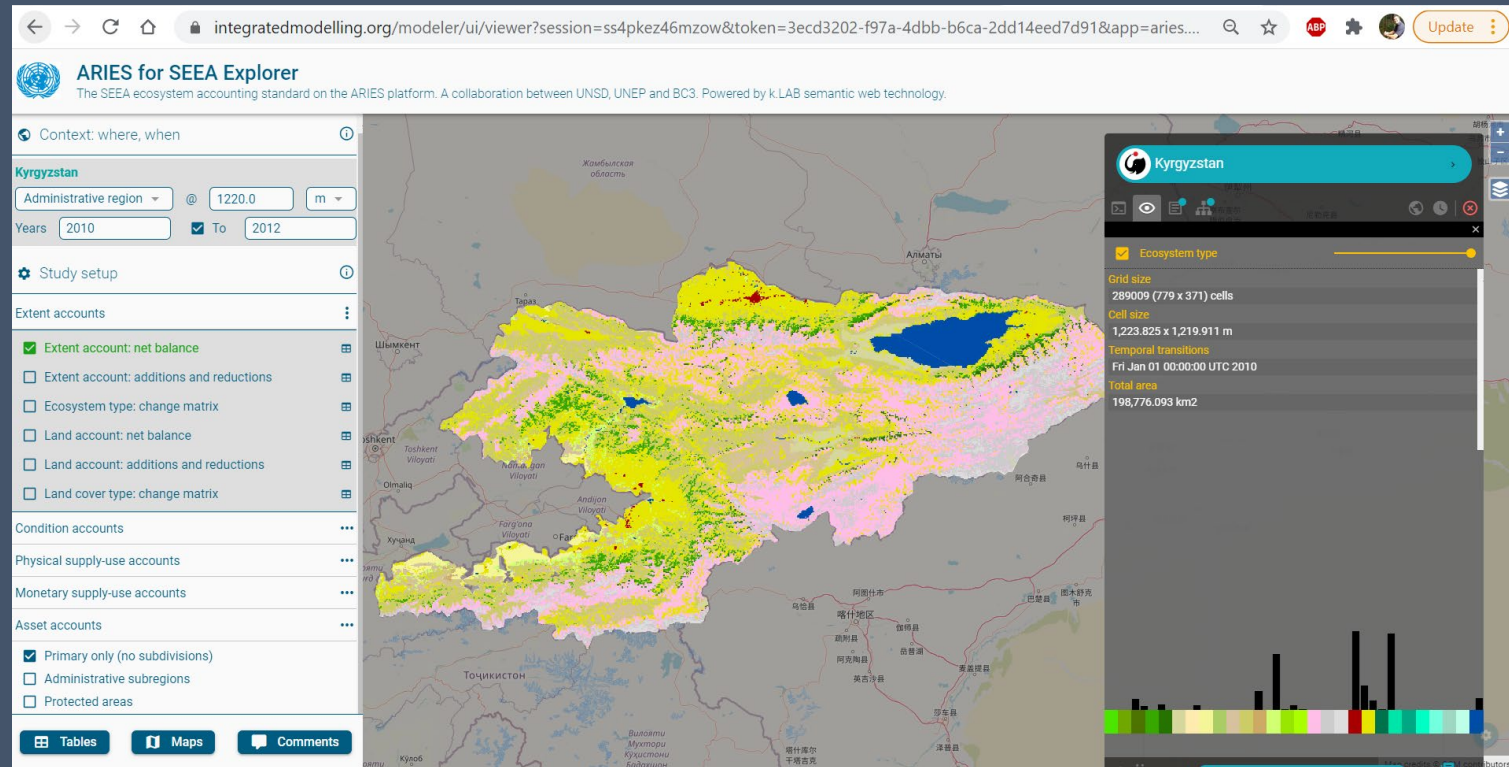


UNEP



Current ARIES for SEEA content

- Ecosystem extent (28 ecosystem types)
- Ecosystem condition (6 forest condition metrics)
- Physical supply & use (carbon, crop productivity, nature-based tourism, pollination, sediment regulation)
- Monetary supply & use (all of above except sediment regulation)
- Additional SDG/Post-2020 CBD indicators



Transparent data assembly & reporting

im-data-global-landcover.c3s_lc_300m_2018

This processing step retrieves the contents of a data or model resource from the semantic web. Resources can be data files, data services (using protocols such as OGC or OpenDAP), or may interface to more complex computations or running simulations.

Resources are identified by a unique Uniform Resource Name (URN) used together with the scale of observation to retrieve data or trigger computation. Metadata and provenance records associated with this resource are shown below.

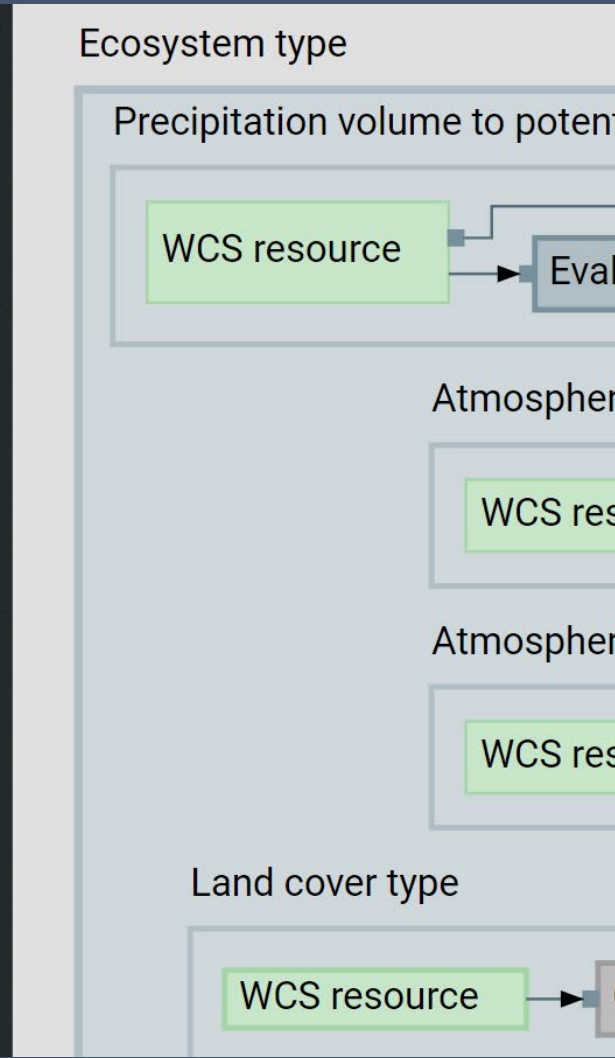
Title
European Space Agency Climate Change Initiative (ESA-CCI) land cover, v.2.1.1

Originator
European Space Agency

Description
The ESA-CCI project has generated annual global land cover maps at 300 m spatial resolution, initially covering the years 1992 to present year and with extension of the time series underway to cover years following 2018.

URL
<https://www.esa-landcover-cci.org/>

Keywords
Land cover



k.LAB Contextualization report

Computed at Mon Jun 22 18:29:14 CEST 2020

1 Introduction

1.1 Ecosystem Extent

The Ecosystem Extent Account is the first SEEA-EEA account. It defines the spatial extent of each ecosystem type, showing how ecosystems change over time. Ecosystem types are used in all other accounts, so are fundamental to SEEA-EEA.

Ecosystems are defined as units whose functioning is governed by resources, ambient environmental conditions, disturbance regimes, biotic interactions, and human activity. Ecosystems in this context should not be confused with habitats (provided by ecosystems for particular species).

A complete list of all the diverse ecosystem types remains a work in progress; IUCN's Global Ecosystem Typology is the current standard proposed for ecosystem accounting [Reference 1](#). IUCN's ecosystem typology improves on past ecosystem extent data, which for many past SEEA-EEA applications relied exclusively on land cover data [Reference 2](#).

A full ecosystem extent account includes changes (additions and reductions), as well as net change between opening and closing values among subcomponents of the same ecosystem type and for each accounting period. Each change can be classified into managed expansion/regression, natural expansion/regression, and reappraisals upward or downward. Each ecosystem is influenced by different abiotic and biotic conditions, which interact to produce a supply of ecosystem services in the formulation of the SEEA-EEA.

2 Methods

2.1 Ecosystem Extent

Keith et al. [Reference 1](#) recognize 25 Level 2 ecosystems (termed biomes): four marine, three freshwater, seven terrestrial, four subterranean, and seven in transitional realms. These are further subdivided into 100 Level 3 Ecosystem Functional Groups. However, information is currently lacking on how to map these Level 3 ecosystems using global data. At the biome level, we similarly lack reliable data to distinguish between biome types for all but terrestrial biomes. ARIES thus currently models seven terrestrial biomes as well as open water and wetlands. With additional global data and rules describing how to use spatial data to map the remaining biomes, we will be able to better distinguish additional biomes, as well as ecosystem functional groups.

The methods for mapping Level 2 ecosystems follow's Sayre et al.'s [Reference 3](#) temperature and moisture domains, combined with land cover data in a lookup table. This enables the mapping of ecosystem change over time using the best available data.

landcover	aridity	mean_annual_temperature	mean_july_temperature	ecosystem_type
landcover:Forest	> 0.05	>18	*	ecology.incubation:Tropica
landcover:Forest	> 0.05	0 to 18	*	ecology.incubation:Temper
landcover:Shrubland	> 0.05	>0	*	ecology.incubation:Shrubla
landcover:BareArea	> 0.05	>0	*	ecology.incubation:Shrubla
landcover:LichenMoss	> 0.05	>0	*	ecology.incubation:Shrubla
landcover:Grassland	> 0.05	>0	*	ecology.incubation:Shrubla
landcover:Grassland	> 0.05	>0	*	ecology.incubation:Savann

Coming soon

- April 2021: Public release of ARIES for SEEA
 - Accessibility through U.N. Global Platform
 - Country applications (India, South Africa, Netherlands)
 - Guidance on model customization with national data
- Ongoing discussions on *interoperability for ecosystem services data & models*
 - We work to make statistical data interoperable, need same for SEEA EA

<http://aries.integratedmodelling.org/>
<http://www.integratedmodelling.org/>

Thanks!
kjbagstad@usgs.gov