

System of  
Environmental  
Economic  
Accounting

# ARIES for SEEA Explorer

Artificial Intelligence for SEEA Ecosystem Accounting

United Nations Statistics Division



United Nations

# Why artificial intelligence?

- Governments often face high barriers to entry in producing ecosystem accounts
  - Ecosystem accounting has high data needs
  - Large amounts of data result in long processing times, making compilation a slow exercise
  - Ecosystem accounting often makes use of biophysical models which require technical expertise
- Ecosystem accounting would benefit from data and models which are *Findable, Accessible, Interoperable* and *Reusable* (FAIR)

 **Findable**

 **Accessible**

 **Interoperable**

 **Reusable**

# Artificial Intelligence for Environment & Sustainability (ARIES)

- What is ARIES?
  - ARIES is a modelling technology, rather than a single model, collection of models or specific program/application
  - It is an artificial intelligent modeler



- It defines a variety of data, models and the relationships between them using consistent and uniform terms. This allows different data and models to be used together, depending on which data and models are “most appropriate” for your context
- ARIES technology uses artificial intelligence to determine the “most appropriate” data and model for your request

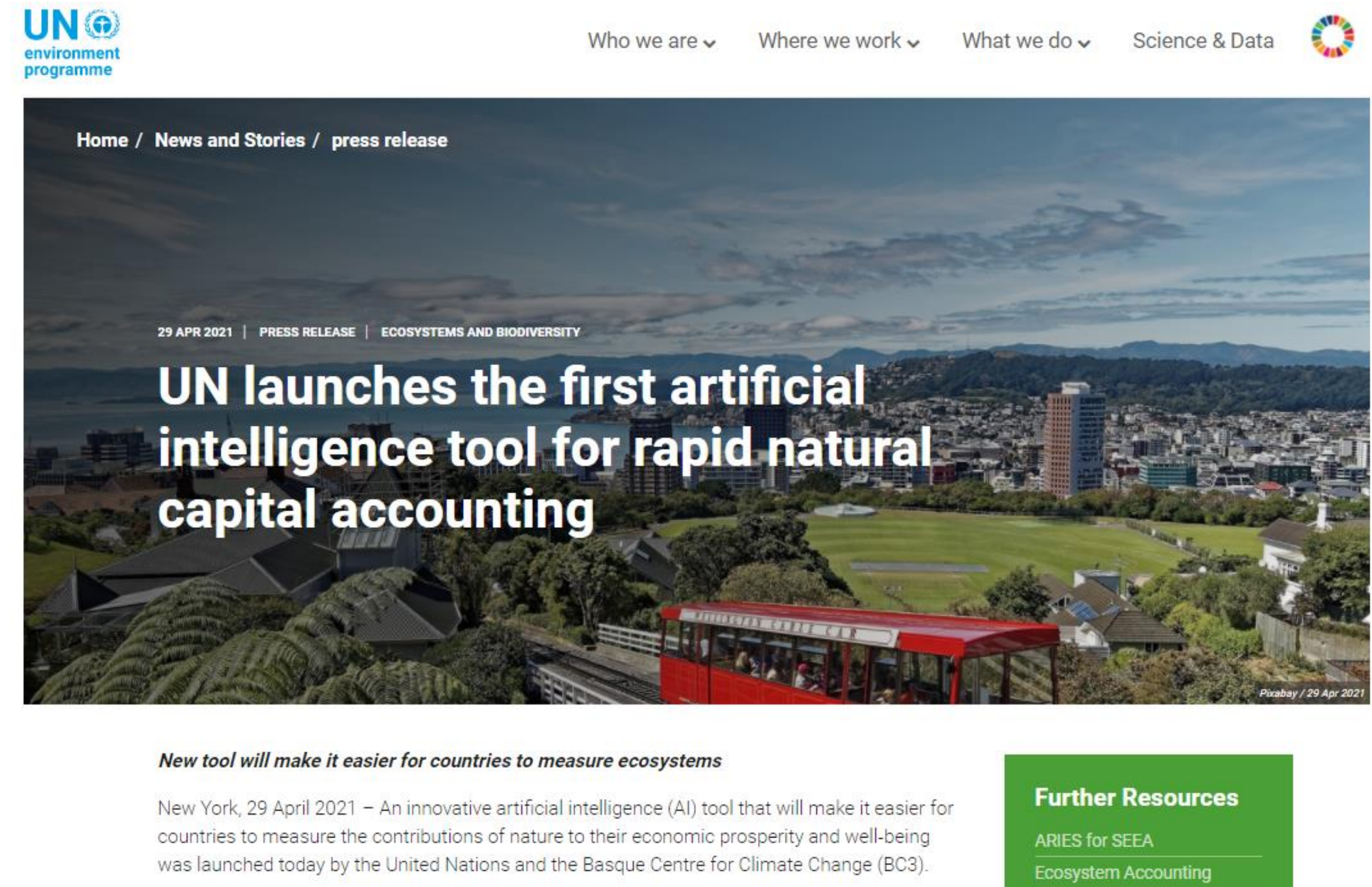
# Artificial Intelligence for Environment & Sustainability (ARIES)

- What can ARIES be used for?
  - Spatial mapping and quantification of ecosystem services
  - Spatial economic valuation of ecosystem services
  - Conservation planning
  - Spatial policy planning
  - Forecasting changes in ecosystem service provisioning
  - **Natural capital accounting**



# What is ARIES for SEEA?

- Tool that uses ARIES technology to compile ecosystem accounts that are consistent with the SEEA Ecosystem Accounting
- Includes land cover accounts consistent with the SEEA Central Framework
- Uses same definitions, classifications, accounting rules as the SEEA
- Can help automate production of maps and tables
- Provides infrastructure for the SEEA community to share and reuse interoperable data and models





# What is ARIES for SEEA?


- Utilizes freely available global remote-sensing derived data and models
- Can generate accounts for any user-specified terrestrial area in the world
- Rapidly computes these accounts online, using a web browser
- Generates a comprehensive report, fully documenting the data, models, coefficients and methods used

**Table 1. Occurring ecosystem types (selected level 3 Ecosystem Functional Groups of the IUCN Global Ecosystem Typology 2.0)**

	Intertidal forest shrubland	Coastal saltmarsh reedbed	Cropland	Urban industrial ecosystem	Temperate
Extent at start of 2012 (km²)	158.25	366.39	16017.82	650.13	390.60
Extent at start of 2014 (km²)	158.25	360.81	15978.72	692.57	403.63
Net change	0.00	-5.59	-39.10	42.45	13.03

**Table 2. Occurring ecosystem types (selected level 3 Ecosystem Functional Groups of the IUCN Global Ecosystem Typology 2.0)**

		Intertidal forest shrubland	Coastal saltmarsh reedbed	Cropland	Urban industrial ecosystem
Opening extent (at start of 2012)		158.25	366.39	16017.82	650.13
	Additions to extent				
	Expansions	0.00	0.00	32.39	42.45
	Reductions in extent				
	Regressions	0.00	5.59	71.49	0.00
Net change in extent		0.00	-5.59	-39.10	42.45
Closing extent (at start of 2014)		158.25	360.81	15978.72	692.57



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 ecosystem extent changes 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.

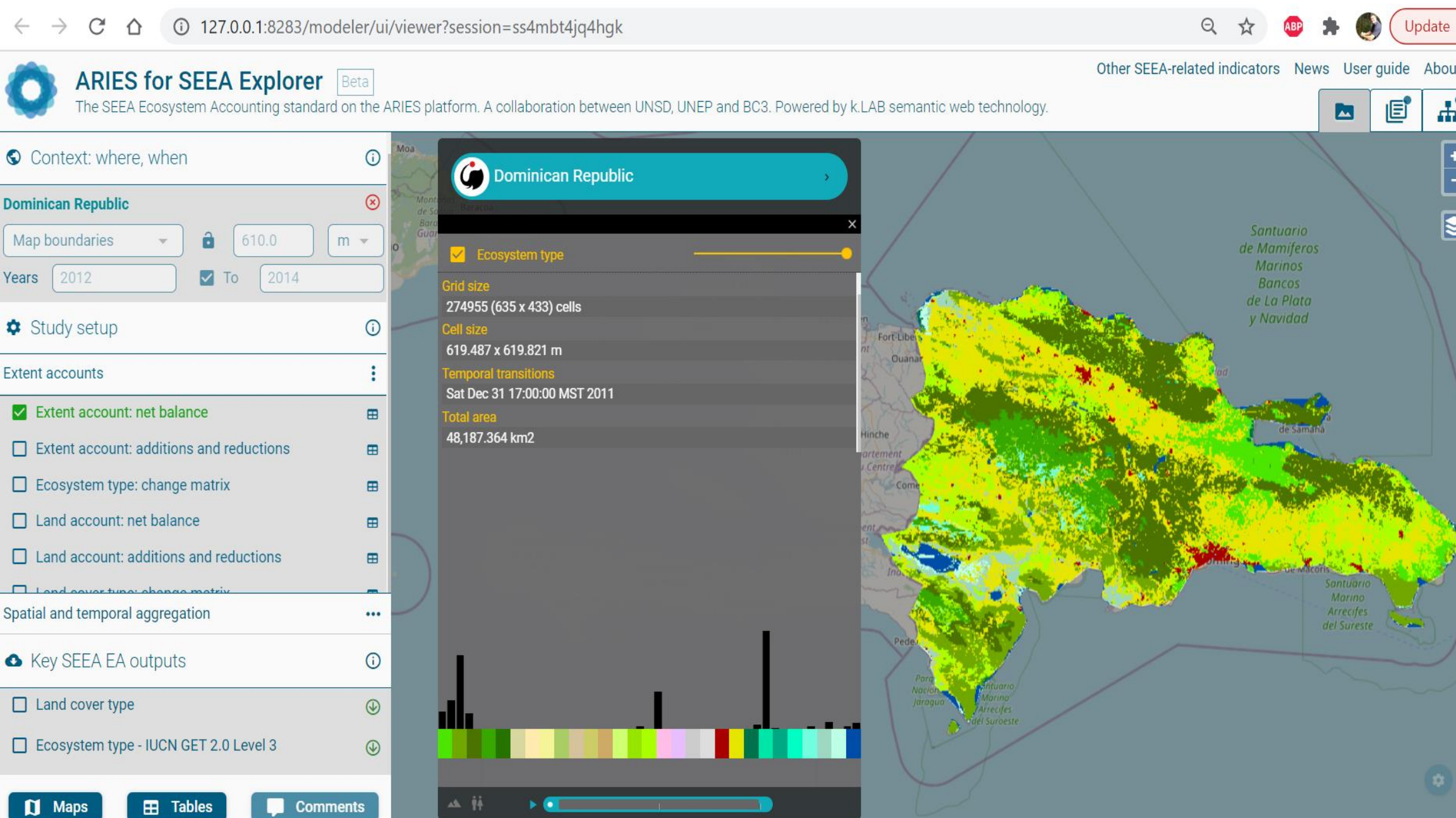
The methods for mapping Level 2 ecosystems follow's Sayre et al.'s [Reference 3](#) temperature and moisture domains, combined with land cover data in a lookup table. This enables the mapping of ecosystem change over time using the best available data.

landcover	aridity	mean_annual_temperature	mean_july_temperature	ecosystem_type
landcover:Forest	> 0.05	>18	*	ecology.incubation:Tropical
landcover:Forest	> 0.05	0 to 18	*	ecology.incubation:Temperate
landcover:Shrubland	> 0.05	>0	*	ecology.incubation:Shrubland
landcover:BareArea	> 0.05	>0	*	ecology.incubation:Shrubland
landcover:LichenMoss	> 0.05	>0	*	ecology.incubation:Shrubland
landcover:SparseVegetation	> 0.05	>0	*	ecology.incubation:Shrubland
landcover:Grassland	> 0.05	>0	*	ecology.incubation:Savanna

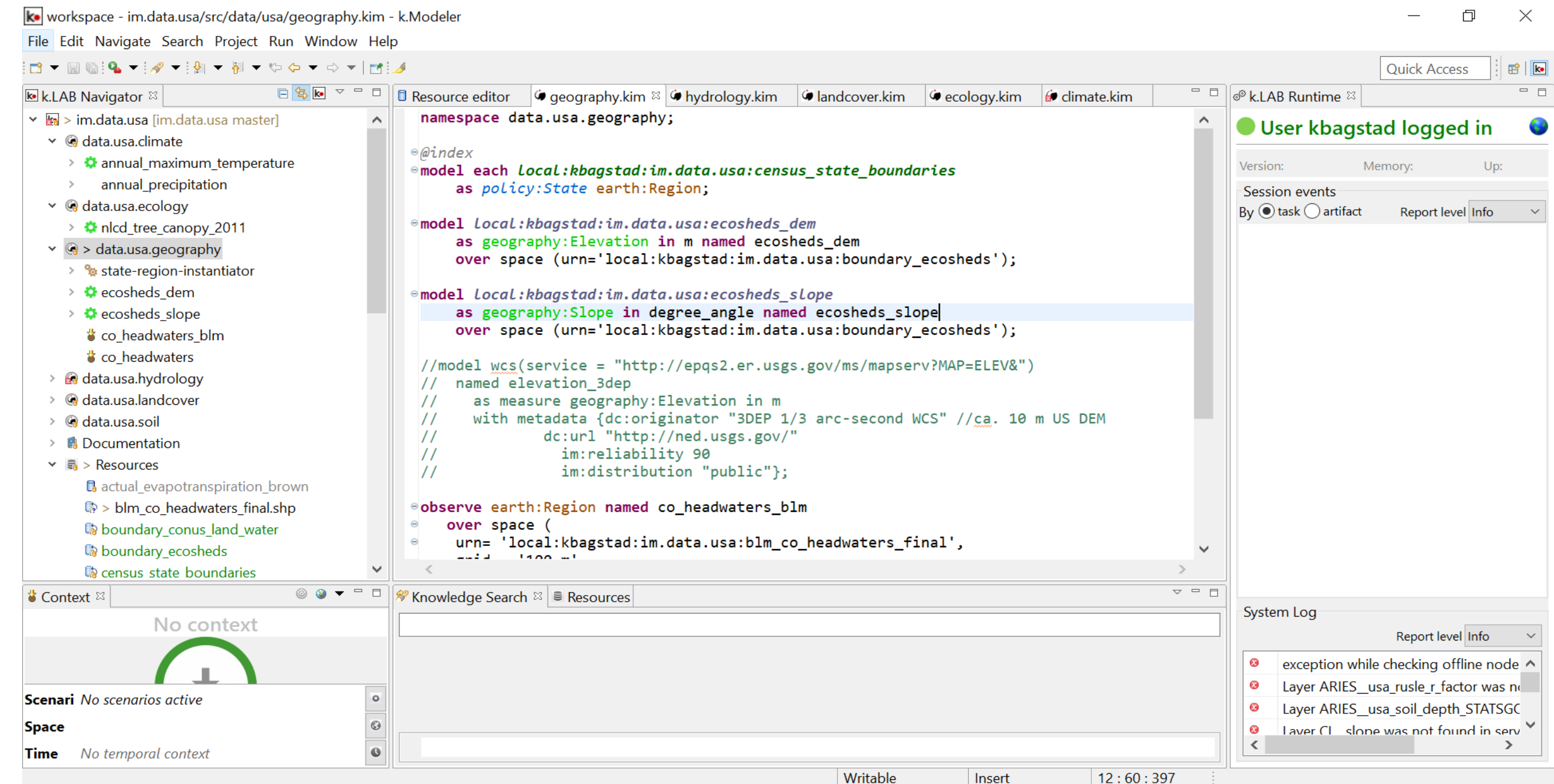




# Interfaces for technical and non-technical users



Access & run scientific models in minutes through a web browser, using cloud-based data, anywhere on Earth



Contribute & semantically annotate new data & model resources for reuse by scientific community & public

# Demonstration

- Helpful links:
  - Webpage: <https://seea.un.org/content/aries-for-seea>
  - Access guide: [https://seea.un.org/sites/seea.un.org/files/how\\_to\\_access\\_the\\_aries\\_for\\_seea.pdf](https://seea.un.org/sites/seea.un.org/files/how_to_access_the_aries_for_seea.pdf)
  - User guide: <https://aries.integratedmodelling.org/aries-for-seea-user-guide/> (browser) or <https://aries.integratedmodelling.org/aries-for-seea-documentation/> (phone/tablet)
  - Factsheet: [https://seea.un.org/sites/seea.un.org/files/aries\\_for\\_seea\\_factsheet.pdf](https://seea.un.org/sites/seea.un.org/files/aries_for_seea_factsheet.pdf)
  - Demonstration and Q&A session for EU Green Week 2021: <https://aries.integratedmodelling.org/aries-for-seea-explorer-the-first-ai-tool-for-rapid-natural-capital-accounting/>
  - ARIES for SEEA launch: <https://youtu.be/HLy3nVNWprc>
  - ARIES technology: <https://aries.integratedmodelling.org/>

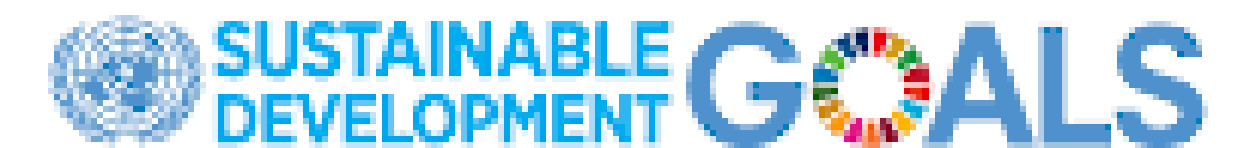


# Next steps for ARIES for SEEA

- Virtual regional workshops
- Improvements to interface and models, including ability to upload custom data in the web explorer
- Expand to more ecosystem types, especially freshwater/marine
- Expand to additional ecosystem condition metrics
- Adding more models (nature-based tourism, water provisioning)

# Next steps for ARIES for SEEA

- Given linked data and models, ARIES can report nearly any SEEA-relevant SDG or post-2020 Global Biodiversity Framework indicator
- Potential for custom SDG/Post-2020 application
- Potential indicators:
  - Change in the extent of ecosystems
  - Forest fragmentation index
  - Level of erosion
  - Total climate regulation services provided by ecosystems
  - Mountain Green Cover Index
  - Proportion of biodiversity hotspots covered by protected areas (pending data availability)
  - Value of (selected) final ecosystem services (GEP)





# THANK YOU

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