

System of
Environmental
Economic
Accounting

Compiling ecosystem accounts using ARIES for SEEA Explorer

Bram Edens, PhD.

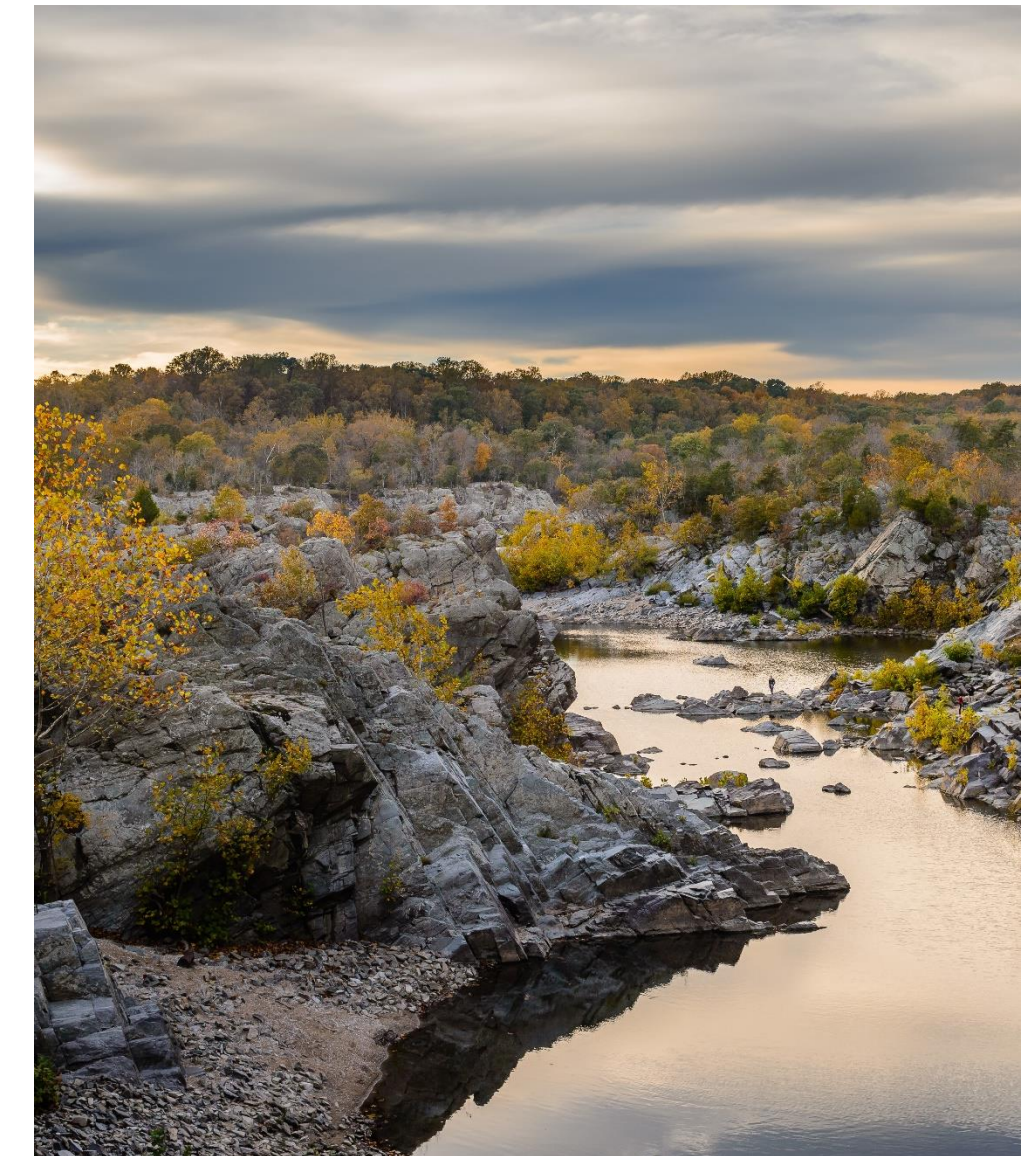
United Nations Statistics Division



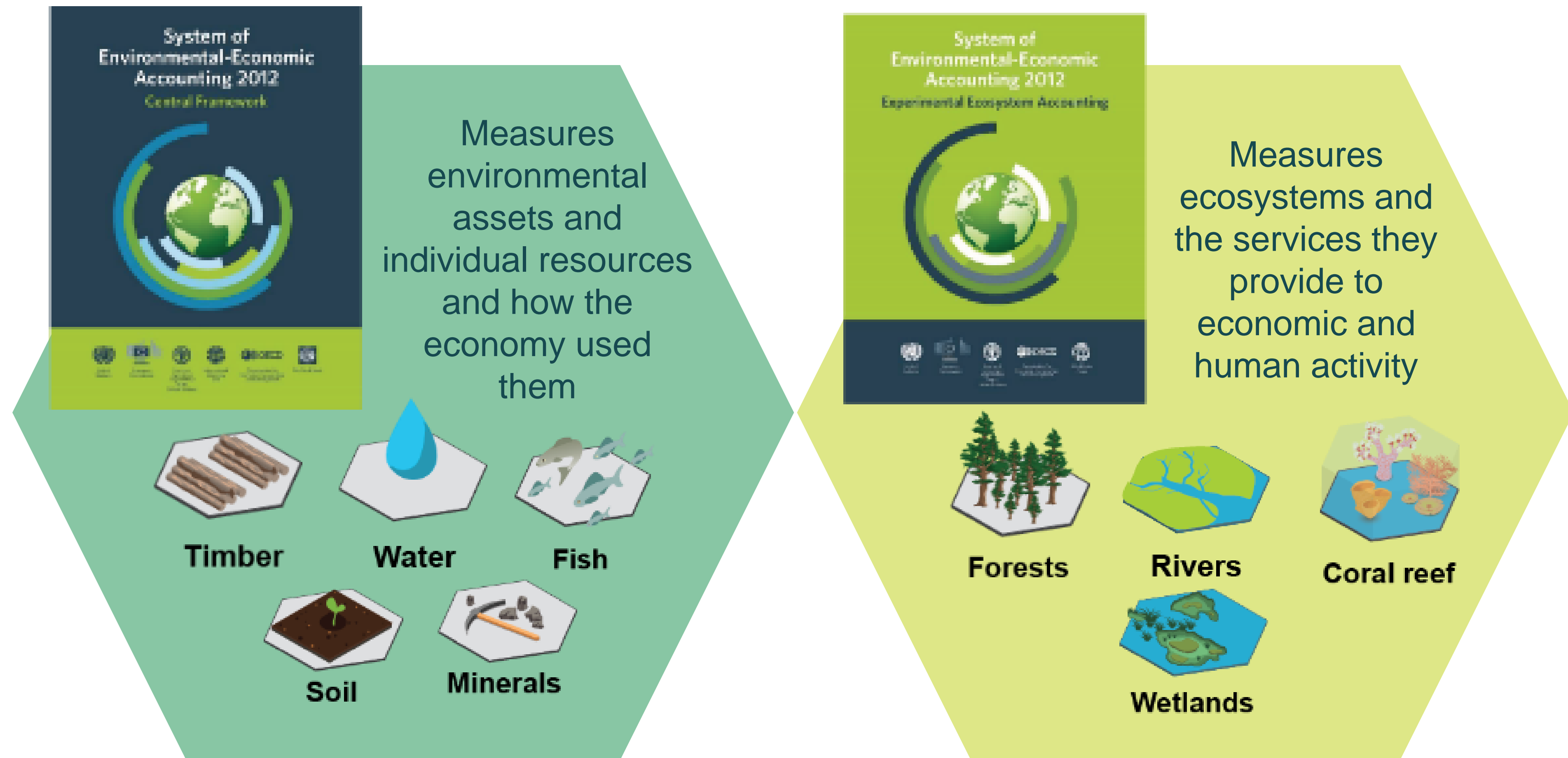
United Nations

The need for environmental economic accounts

- Our economic well-being crucially depends on nature.
- But headline indicators like GDP or the unemployment rate do not capture these vital contributions.
- As a result, decision makers don't have access to key information necessary to effectively pursue and track sustainable development.
- The System of Environmental Economic Accounts (SEEA) fills that gap.
- SEEA integrates information on the economy and the environment showing their interrelationship complementing the System of National Accounts



Two sides of the SEEA

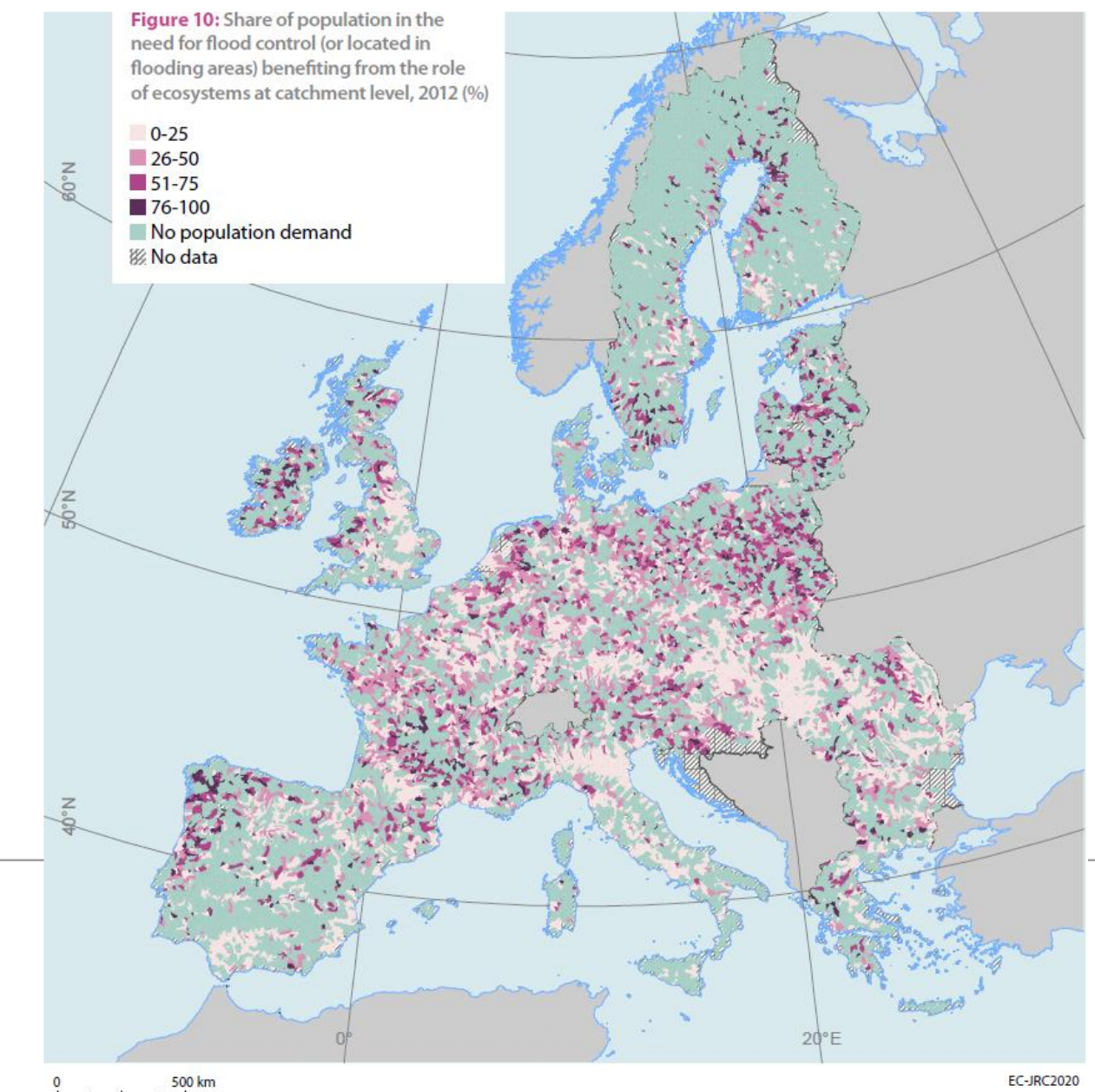


Asset & Resources + Ecosystems = SEEA

- Regulation (EU) No 691/2011 on environmental accounts
- Mandatory reporting since 2014 / 2017 for: air emission accounts, environmental taxes, material flow accounts, energy accounts, environmental goods and services and environmental protection expenditure accounts
- Proposal for amendment: environmental subsidies, **forest accounts and ecosystem accounts (extent, condition, ecosystem services)**

Compilation of ecosystem accounts in the EU

- In 2015, the EU launched a pilot project for an integrated system of ecosystem accounting, INCA
 - > Resulted in the compilation of extent, condition and ecosystem services accounts (Vysna et al., 2021)
- Some of the findings are:
 - > Urban ecosystems increased in extent by 5.8% (2000 – 2018) at the expense of farmland and semi-natural ecosystem.
 - > Monetary value of 7 services assessed EUR 172 billion in 2012
 - > Forests deliver 47.5% of the total supply of the measured ecosystem services
 - > More than half of the societal demand for essential ecosystem services (e.g. pollination) in the EU is not met by ecosystems.



SEEA Implementation

- UN undertakes an annual Global Assessment to stock-take SEEA implementation:
- SEEA status of implementation 2020:
 - > 89 countries implementing the SEEA Central Framework
 - > 34 countries compiling SEEA Ecosystem Accounts
 - > 27 countries planning to start implementation of the SEEA
- Developing a Global SEEA EA implementation strategy to scale-up implementation
 - > Capacity building
 - > Development of guidelines and material to support compilation
 - > Strengthening collaboration
 - > Data (global databases)
 - > Communication and advocacy
 - > Tools such as **ARIES for SEEA**


Video

UN launches the first
open-source technology for
rapid natural capital accounting

ARIES for SEEA Explorer

- Application (by BC3) built on Aries platform:
 - Uses global data and models to generate a basic set of ecosystem accounts
 - Aries has around 150 global data layers, many of them based on EO (e.g. land-cover; elevation; precipitation)
 - Enables compilation anywhere on earth (country; watershed;)
 - Improvement with national data where available
 - Fast & easy to learn
 - Automates production of maps & tabular output


<https://seea.un.org/content/aries-for-seea>



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29 APR 2021 | PRESS RELEASE | ECOSYSTEMS AND BIODIVERSITY

UN launches the first artificial intelligence tool for rapid natural capital accounting

Pirabay / 29 Apr 2021

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
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

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 the 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:Shrubia
landcover:BareArea	> 0.05	>0	*	ecology.incubation:Shrubia
landcover:LichenMoss	> 0.05	>0	*	ecology.incubation:Shrubia
landcover:SparseVegetation	> 0.05	>0	*	ecology.incubation:Shrubia
landcover:Grassland	> 0.05	>0	*	ecology.incubation:Savanna

Current ARIES for SEEA content: Ecosystem extent

Methods

Currently maps **29 ecosystem types** (primarily terrestrial & wetland) based on IUCN GET 2.0 methods¹.

Data

Lookup table to model **IUCN EFGs**, based on: **temperature, landform, elevation, aridity, land cover**², ca. 1992-2019

Outputs

Net change, additions & reductions, change matrix for ecosystems & land cover types

Next Steps

Expand to more ecosystem types (especially freshwater/marine), though conceptual/data challenges remain; collaborate more closely with IUCN GET team

1: Keith, D. et al. 2020. IUCN Global Ecosystem Typology 2.0. IUCN: Gland, Switzerland. - **2: Using thresholds from Sayre, R., et al. 2020.** An assessment of the representation of ecosystems in global protected areas using new maps of World Climate Regions and World Ecosystems. Global Ecology and Conservation 21:e00860.

Current ARIES for SEEA content: Ecosystem condition

Methods

Identifies forest ecosystem condition with 6 indicators adapting Santos' aggregation methods¹

Data

Drought index, LAI, NDVI, NPP, forest fragmentation, burned area. Adapted from original temporal resolution to yearly values (e.g., mean, maximum), ca. 2000-2019

Outputs

Ecosystem variable, indicator, index accounts for user-selected indicators

Next Steps

Expand to additional ecosystem types/condition metrics (based on Ecosystem Condition Typology)

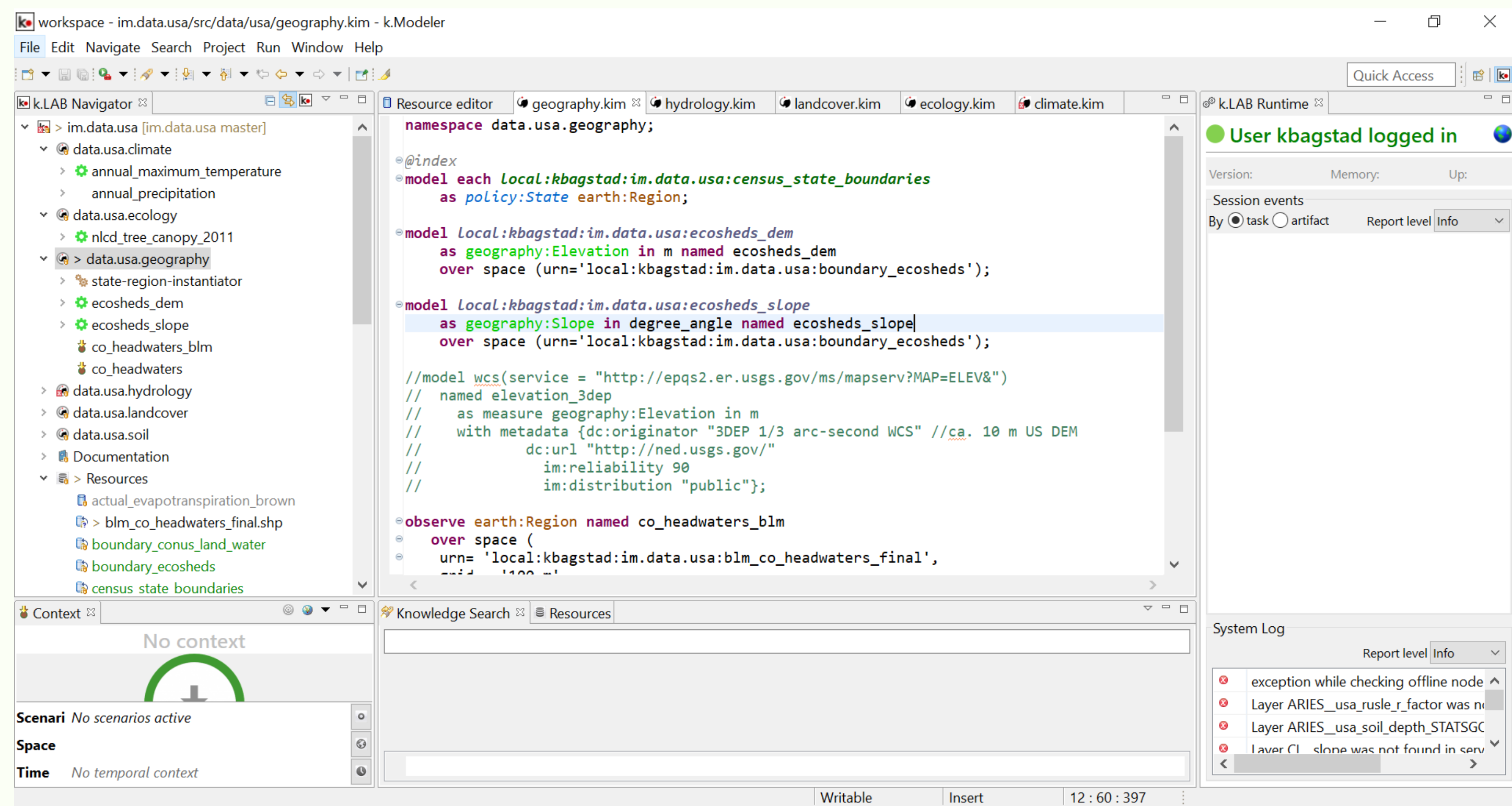
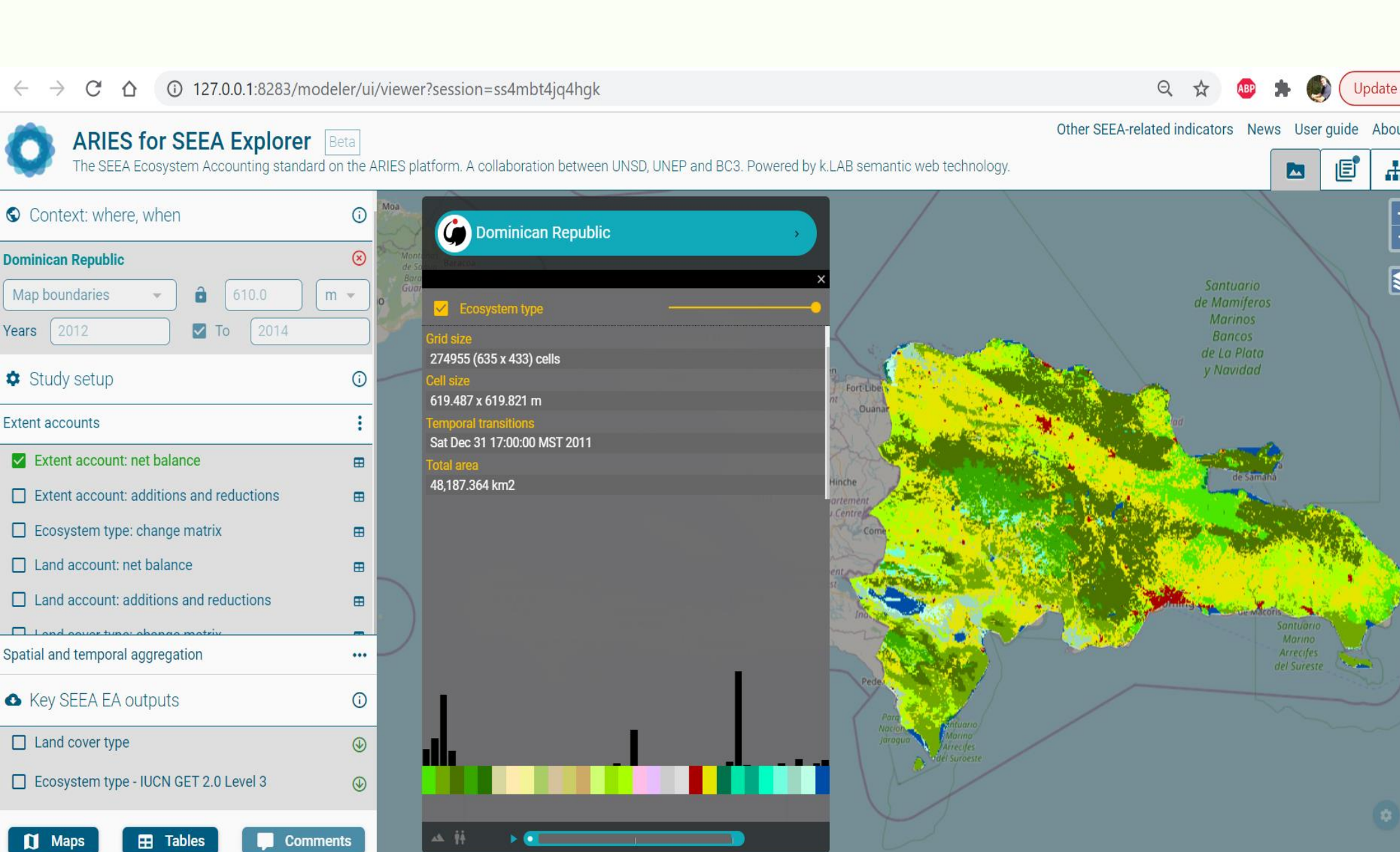
1: Santos Martin, F. & Garcia Bruzon, A. In prep. Spanish forests experimental condition account. Universidad Rey Juan Carlos: Madrid.

Current ARIES for SEEA content: Ecosystem services

Supply and use tables

Ecosystem Services and Accounts:			Physical	Monetary
1.	Crop provisioning (ecosystem contribution)		✓	✓
2.	Crop pollination (insect pollinators contribution)		✓	✓
3.	Global climate regulation services (carbon storage)		✓	✓
4.	Soil erosion control services (physical only)		✓	—
5.	Nature-based tourism (non-domestic)		✓	✓

Interfaces for non-technical & 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

ARIES for SEEA: Audiences

1. Countries with **very limited data & experience** (create accounts using common global data)
2. Countries with **national data wanting to customize accounts** (create accounts using national data & models)
3. Countries with **sophisticated modeling capacity** (contribute their data & models to global SEEA EA community)

Current focus has been on group 1; increasing focus on groups 2 & 3 in near future.

Conclusions

- With adoption of SEEA EA – focus is now on implementation
- Aries for SEEA allows to rapidly generate a set of basic accounts that can be improved with national data and models
- Good example of how Earth Observation data can be used for official statistics
- Encourage NSOs to test the ARIES for SEEA Explorer and / or contribute data and/ or models as part of interoperability strategy
- Further info:
 - > <https://seea.un.org/content/aries-for-seea>
 - > <https://aries.integratedmodelling.org/>

THANK YOU

seea@un.org // <https://seea.un.org/>

