System of Environmental Economic Accounting

Measuring climate regulation services using ARIES for SEEA Explorer

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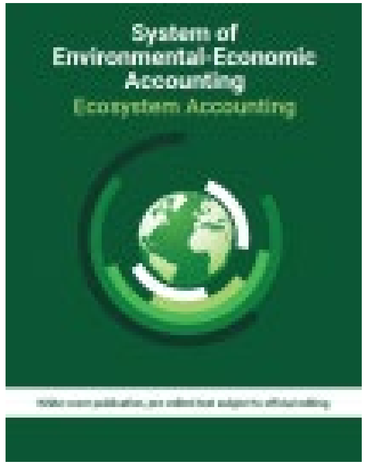
Outline

- Role of SEEA in informing climate policy
- Climate regulation service
- Aries for SEEA
- Brief demonstration
- Interoperability

Context: SEEA and Climate Change

Climate-related uses of the SEEA, include:

- Informing **mitigation strategies** by assessing the role of economic activities and household consumption in generating emissions by economic sector, the value of investments in mitigating technologies, as well as the distribution of carbon credits.
- Informing **adaptation strategies** by tracking expenditures and investments on adaptation by economic sectors or household and analyzing impacts in terms of changes in condition of ecosystems, disasters, and reduced production, for example of crops.
- Providing a comprehensive overview of how much **carbon is stored per ecosystem type** and how this develops over time due to sequestration, deforestation and afforestation, as well as harvesting, forest fires etc.
- Assessing how **climate change impacts** economic activities and households, through the effects it has on ecosystems and the services they provide. The accounts can also be used to assess issues such as land degradation, water shortages and biodiversity.

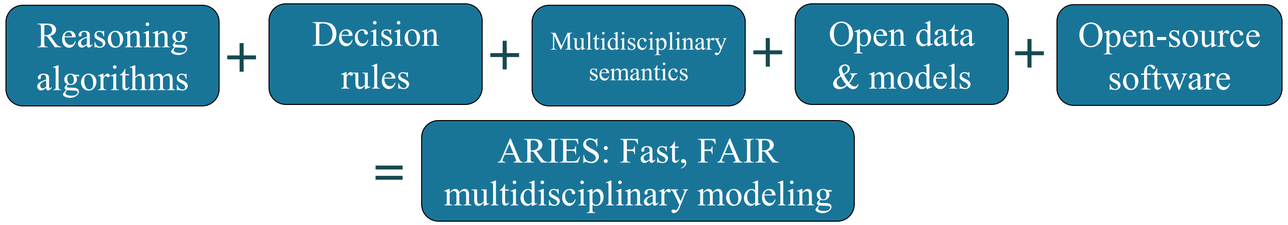


Global climate regulation service

- Global climate regulation service in SEEA EA considers two components:
  - carbon retention: the ability of ecosystems to retain the stock of carbon – i.e., ecosystems supply a service through the avoided emission of carbon to the atmosphere
  - carbon sequestration: the ability of ecosystems to remove carbon from the atmosphere
    - expected to be stored for long periods of time.
    - an appropriate metric is the net ecosystem carbon balance.
- In stable ecosystems, carbon retention will be the primary component while in those ecosystems where there is clear expansion in the stock of carbon, then carbon sequestration may be the focus of measurement.
- Requires compilation of a basic carbon stock account.

Artificial Intelligence for Environment & Sustainability (ARIES)

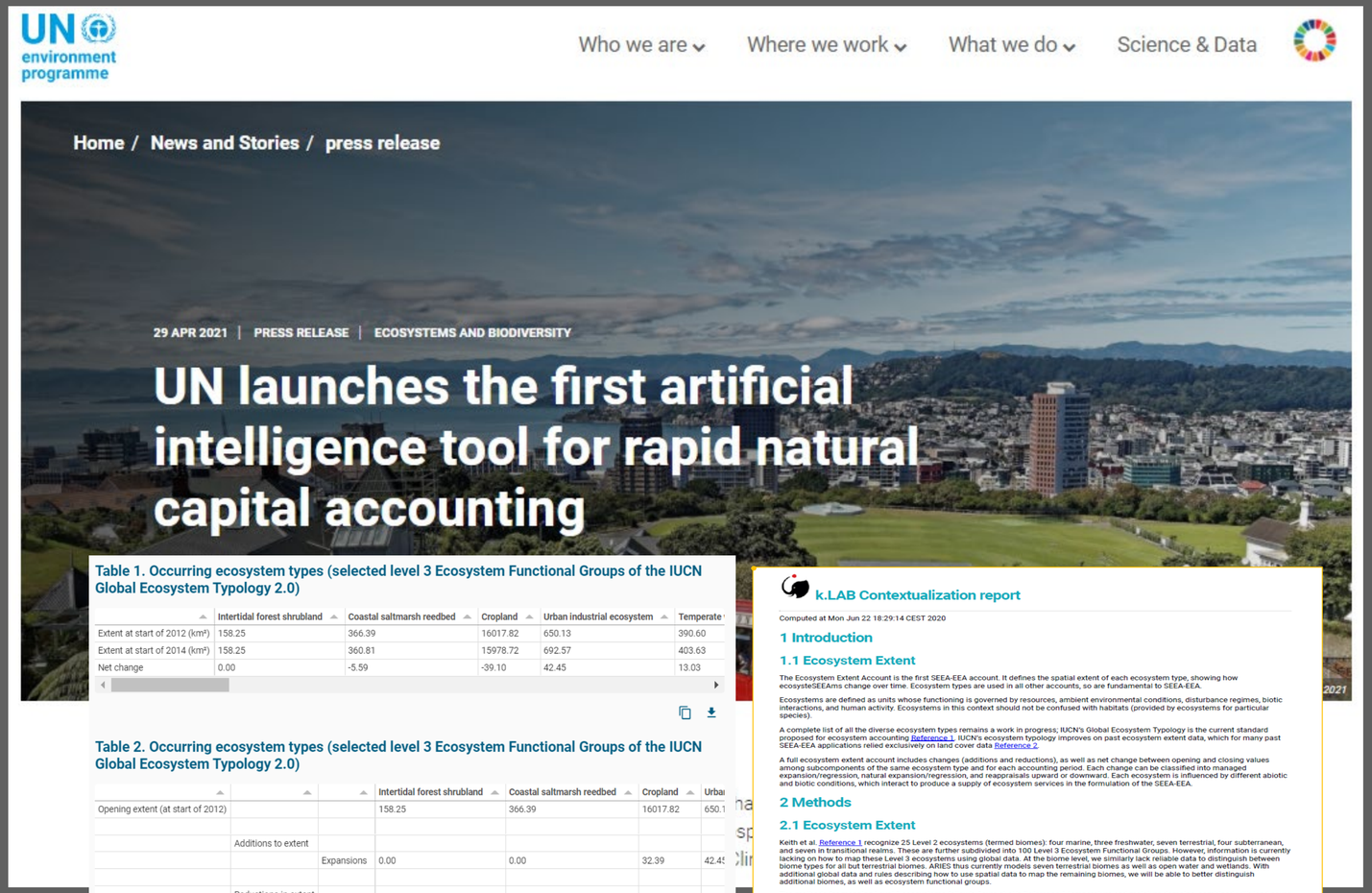
- What is ARIES?
  - ARIES is a modelling technology, rather than a model(s), or specific program/application
  - Uses k.Lab software (knowledge)
  - It is an artificial intelligent modeler, based on machine reasoning



- It defines a variety of data, models and the relationships between them using consistent and uniform terms (semantics / ontology).
- ARIES technology uses artificial intelligence to determine the “most appropriate” data and model for your request (setting a context)

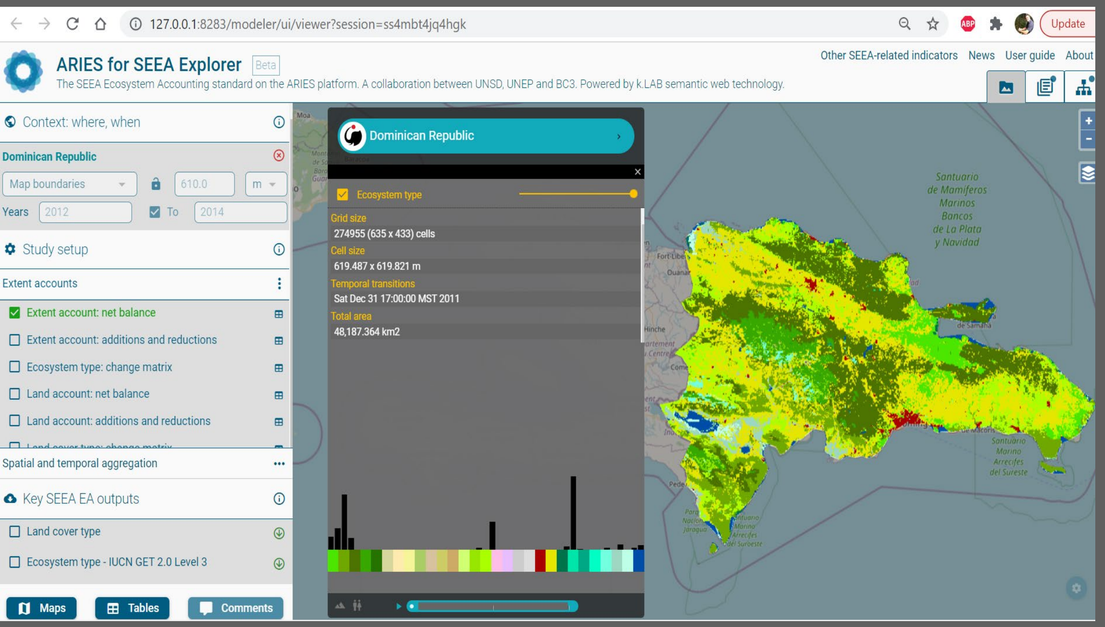
ARIES for SEEA:
Rapid, standardized environmental-economic accounting

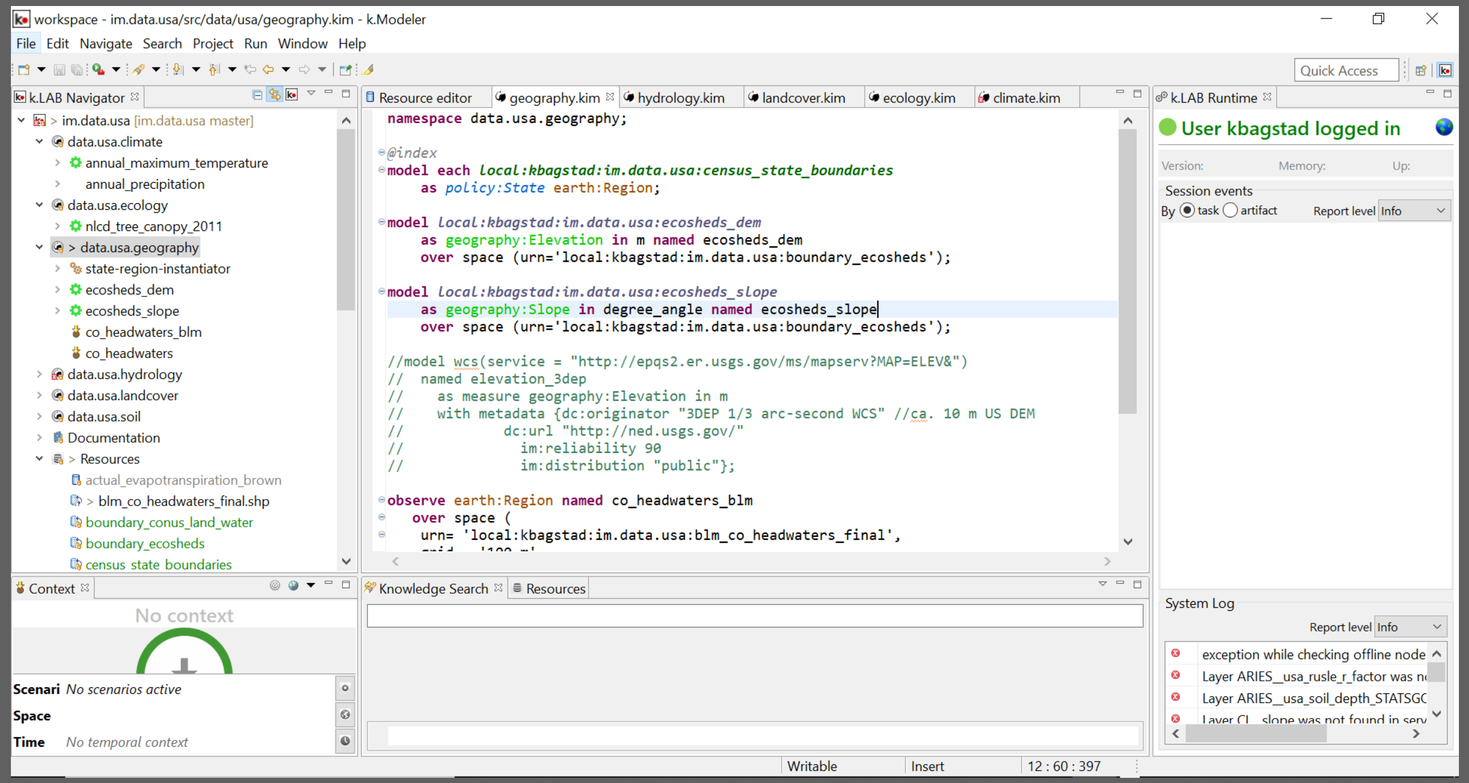
- Global, customizable models approach enables SEEA EA compilation anywhere & improvement with local data where available
  - Fast & easy to learn
- Automate production of maps & tabular output
- Infrastructure for the community to share & reuse interoperable data & models



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

Interfaces for nontechnical & 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

Current ARIES for SEEA content: Ecosystem extent

Methods	Data
Currently maps **29 ecosystem types** (primarily terrestrial & wetland) based on IUCN GET 2.0 methods[1].	Lookup table to model **IUCN EFGs,** based on: **temperature, landform, elevation, aridity, land cover**[2], ca. 1992-2019
Outputs	**Next Steps**
Net change, additions & reductions, change matrix for ecosystems & land cover types	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 methods**[1]: Consulted virtually with J. Maes, F. Santos and colleagues

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 (e.g., collaboration with South Africa on grassland condition)
Customizable weighting to reflect local ETs' characteristic

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 & 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)	✓	✓

Current ARIES for SEEA content: Global climate regulation

Methods

Tier 1 IPCC approach: Aboveground & belowground vegetation carbon storage quantified using a multilayer lookup table[1].

Data

Land cover, ecofloristic region (FAO classification), continent, presence of frontier forests (proxy for forest degradation), recent occurrence of fires, soil carbon storage.

Outputs

Estimated carbon stored in aboveground & belowground vegetation, plus the upper 2 m of soil. Results priced using Social Cost of Carbon (SCC).

Next Steps

Incorporate newer & more regional carbon storage estimates, as well as models more sophisticated than lookup tables.

1: Ruesch, **A., & H.K. Gibbs**. **2008**. New IPCC Tier-1 Global Biomass Carbon Map for the Year 2000. Available online from the Carbon Dioxide Information Analysis Center [http://cdiac.ornl.gov], Oak Ridge National Laboratory, Oak Ridge, Tennessee

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.

Results: demonstration

- Kyrgystan: carbon storage
  - > Disaggregation by IUCN EFGs
  - > Time series: 2012-2014
- Allows to compute both components of global climate regulation service:
  - > Sequestration (net balance)
  - > Retention (for opening and closing stocks)

(million tC)	Cropland	Urban industrial ecosystem	Polar tundra desert	Polar alpine rocky outcrop	Alpine grassland shrubland	Ice sheet glacier permanent snowfie	Temperate woodland	Temperate subhumid grassland	Rocky pavement lavaflow scree	Cool temperate heathland	Seasonally dry temperate heath shr	Boreal temperate montane forest w	Temperate forest	Other desert semidesert	Cool desert semidesert	Total
Quantity at start of 2012 (tons C storage)	1747	11	55	453	2299	39	1	54	301	1190	3	122	264	32	66	6636
Quantity at start of 2014 (tons C storage)	1738	11	56	457	2311	39	1	54	299	1183	3	122	263	31	66	6635
Net change	-9	1	0	4	12	0	0	0	-2	-6	0	0	-1	0	0	-1

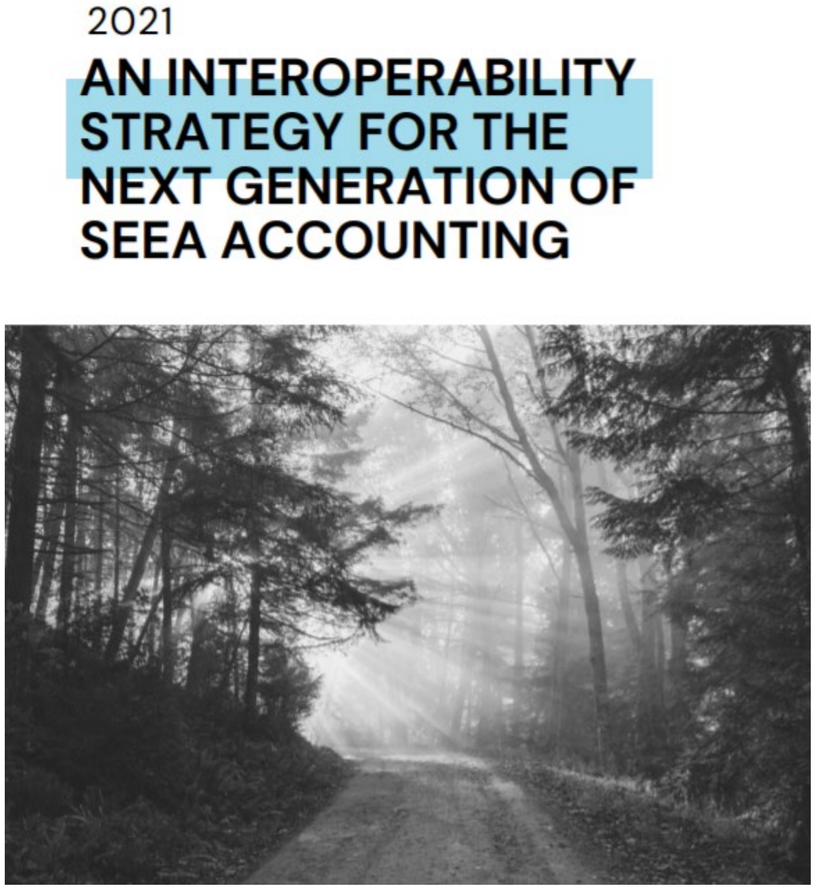
SEEA

The importance of interoperability

- Interoperable data:
  - Interoperable is broader than mere open (downloadable) data.
  - The idea is to share the data through APIs using SDMX etc.
  - Global data can be complemented by reviewed national data sets, all interconnected through common classifications and definitions (semantics/ontology)
- Data storage:
  - Ecosystem accounting requires large data sets which are costly to store -> better have one custodian that shares the data, that updates when new data are available.
- Interoperable models:
  - In ES modelling many platform and models exist.
  - Interoperable allows re-using each other model(s) components; coefficients etc. -> re-use of scientific knowledge.

SEEA Interoperability strategy

1. Current state of interoperability & vision for the future
2. Roles & responsibilities (data providers, modelers, institutions incl. NSOs)
3. Implementing the strategy (pilot testing, engaging key stakeholders, governance, training/capacity building)



https://seea.un.org/sites/seea.un.org/files/interoperability_strategy_draft.pdf

THANK YOU

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