System of Environmental Economic Accounting

Introduction to ARIES for SEEA

Training Workshop on an Accounting Approach to Climate Change and Biodiversity in Central Asia

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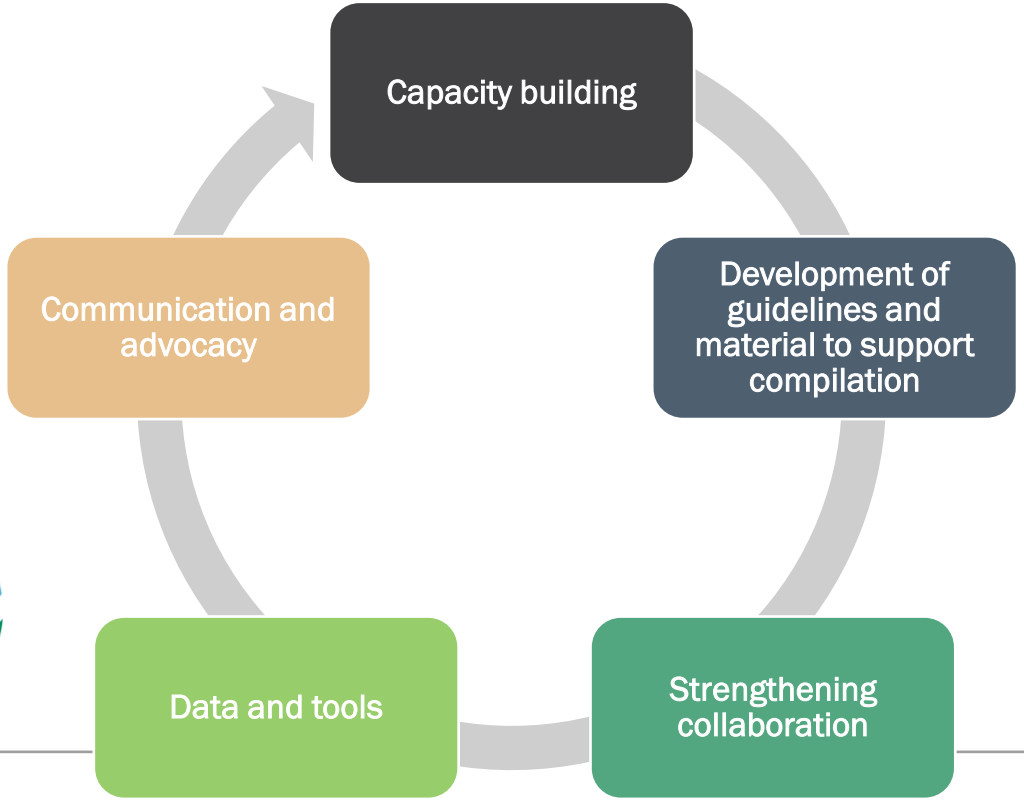
Marko Javorsek
Environmental Economic Accounts Section
United Nations Statistics Division

United Nations

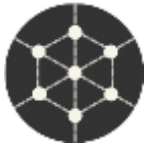
Activities in support of the implementation



Introduction to ARIES

Introduction to ARIES

#1 Decision-makers with limited data and technical capacity often lack **access to scientific knowledge**. Many are left behind due to **cost or technology barriers**.



#2 **Ever-increasing volumes of data** are held in silos – different disciplines, geographies, data types and access rights - making it challenging to connect information and make sense of it.

#3 Public **trust** is one of the biggest hurdles faced by AI technologies. People struggle to accept the decisions and answers that AI-powered tools provide as many do not make their inputs, operations, and end goals visible.

#4 The AI technology ecosystem is currently dominated by Big Tech - enclosed assets - for profit perspective. Although much software is open-source, **access to data remains tightly controlled.**

Solutions offered by ARIES

#1 It is a **modelling technology**, rather than a, collection of models or specific program/application;

#2 It is an **AI modeller**, based on **machine reasoning**, a less known branch of AI;

#3 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 the context set by the user;

#4 It uses AI to determine the "**most appropriate**" data and models for users' requests.

Reasoning algorithms + Decision rules + Multidisciplinary semantics + Open data & models + Open-source software = ARIES: Fast, FAIR multidisciplinary modeling

What can ARIES be used for?

Spatial economic valuation of ecosystem services

Conservation planning

Spatial policy planning

Forecasting changes in ecosystem service provisioning

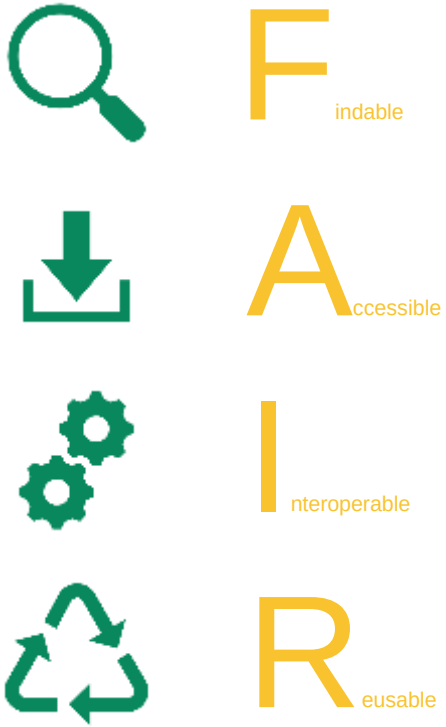
Natural capital accounting

Why artificial intelligence (AI)?

Governments agencies and policy-makers 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).



ARIES: a different approach to environmental modelling

SWAT Soil & Water Assessment Tool

https://swat.tamu.edu/software/plus/

InVEST integrated valuation of ecosystem services and tradeoffs

https://naturalcapitalproject.stanford.edu/software/invest

ARIES ARtificial Intelligence for Environment & Sustainability

https://aries.integratedmodelling.org/get-started/

Ecosystems Knowledge Network

https://ecosystemsknowledge.net/resources/tool-assessor/

European Commission

NATURE BRAID

https://naturebraid.org/

VICTORIA State Government Energy, Environment and Climate Action

EnSym

https://www.environment.vic.gov.au/..../ensym-native-vegetation-regulations-tool

INCA Platform

https://ecosystem-accounts.jrc.ec.europa.eu/about-inca

ESTIMAP: A GIS-BASED MODEL TO MAP ECOSYSTEM SERVICES IN THE EUROPEAN UNION

10.4462/annbotrm-11807

Ecosystems Knowledge Network

SWAT

VICTORIA State Government | Energy, Environment and Climate Action

EnSym

NATURE BRAID

- Programming & GIS skills required to run models

European Commission

INCA Platform

ESTIMAP

Applications to produce NCA results for countries in the European Union to support EU policies

- ✓ No programming skills to run the model
- GIS software plug-in
- Only available for Europe

InVEST

integrated valuation of ecosystem services and tradeoffs

Models based on production functions defining how changes in ecosystem structure & function affect ecosystem service flows & values across land- & seascapes.

- ✓ No programming skills to run the models
- ✓ Standalone application
- Intermediate GIS software skills required
- Need GIS mapping software to visualize results

ARIES

Artificial Intelligence for Environment & Sustainability

Online library of environment & sustainability models & data; WoldWideWeb-like archive of models growing in value to the scientific community with increasing use.

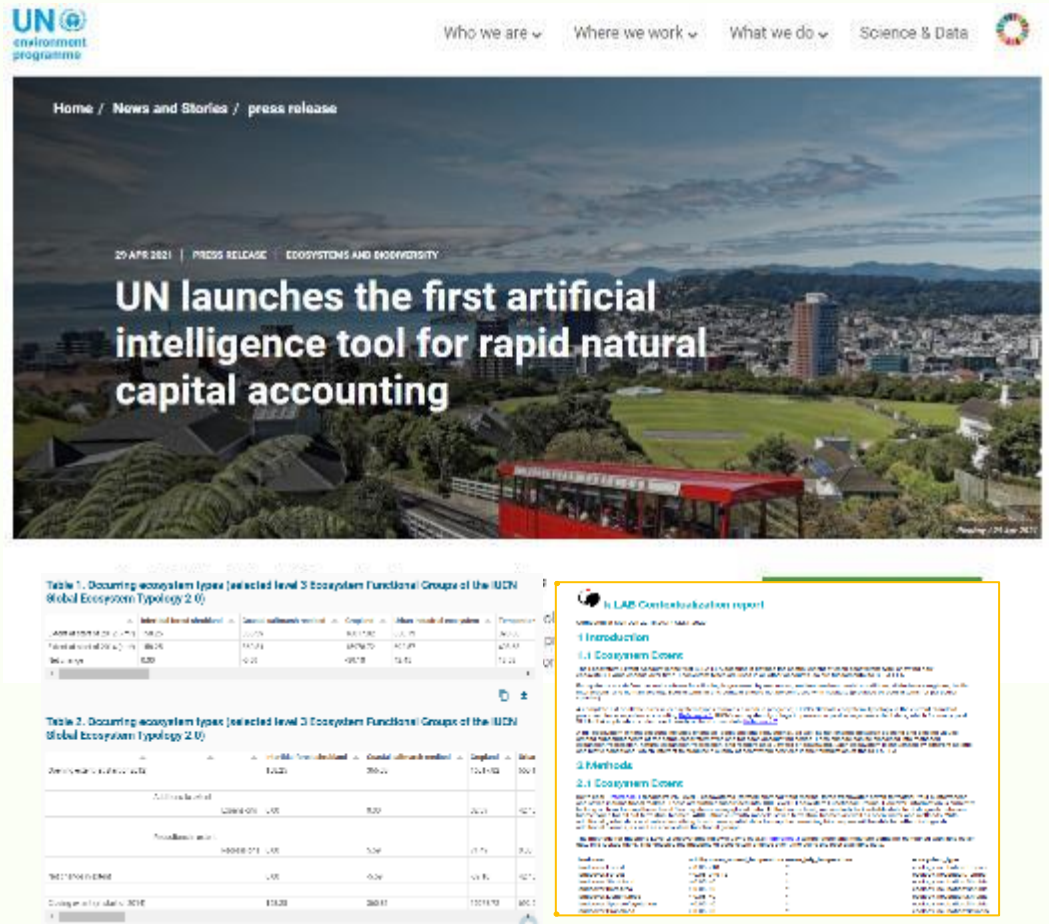
- ✓ Online free-access
- ✓ No programming skills to run the models, nor mapping software (GIS) to visualize results
- ✓ Integrated modelling platform: allows integration of other tools' models & data

Higher to lower barriers to entry

Introduction to ARIES for SEEA

ARIES for SEEA Explorer

- **AR**rtificial **I**ntelligence for **E**nvironment and **S**ustainability
- Application (by BC3) built on ARIES platform:
  - Uses global data and models to generate a basic set of ecosystem accounts
  - Enables compilation anywhere on earth (country; watershed; administrative area)
  - AI -> machine reasoning to construct “best available model”
  - ARIES has > 100 global data layers, many of them based on EO (e.g. land-cover; elevation; precipitation)
  - Improvement with national data where available
  - Transparent (metadata + download)



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

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.

What is the ARIES for SEEA Explorer?

#1 An app, built on the ARIES technology, to compile ecosystem accounts comformant with the **SEEA Ecosystem Accounting**;

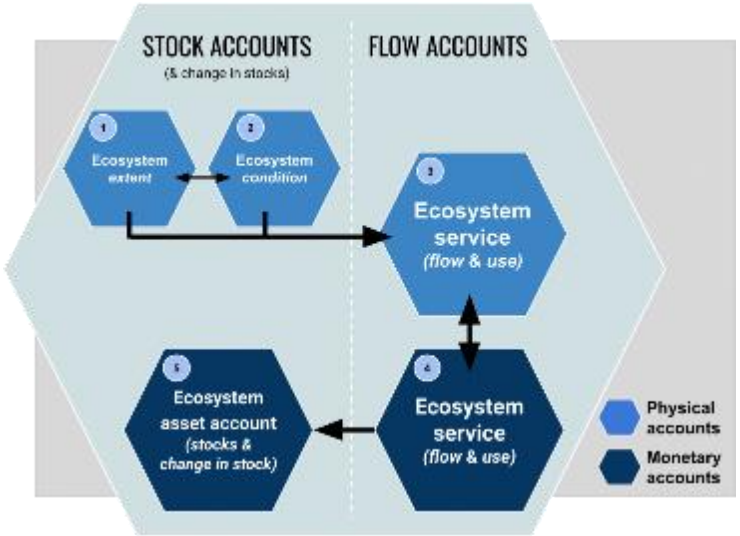
#2 It utilizes remote-sensing **data and models** where governments-endorsed data are not available;

#3 It can generate accounts for **any** user-specified **terrestrial area** in the world;

#4 It **rapidly** computes these accounts online, using a web browser;

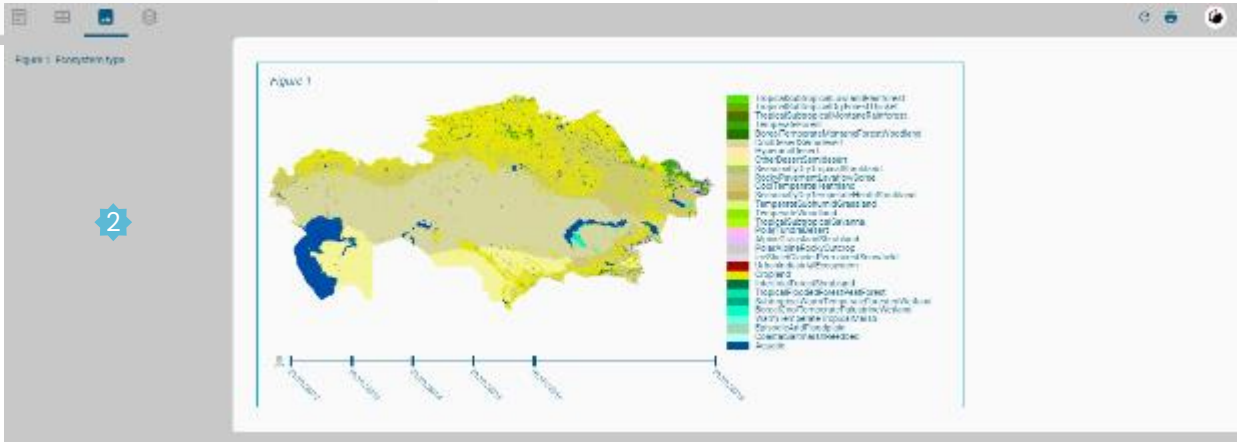
#5 It generates a comprehensive **report**, **fully documenting the data, models, coefficients and methods** used.

System of Environmental Economic Accounting



What are the ARIES for SEEA Explorer's outputs?

#1 A combination of statistical and spatial analysis summarized in **Tables(1)** and **Maps(2)**.



What are the ARIES for SEEA Explorer's outputs?

#2 Full transparency for replicability and traceability through **Reports(1)**, a **Resource Section(2)** & a **Dataflow Diagram(3)**.

Two type of users:

Non-technical users

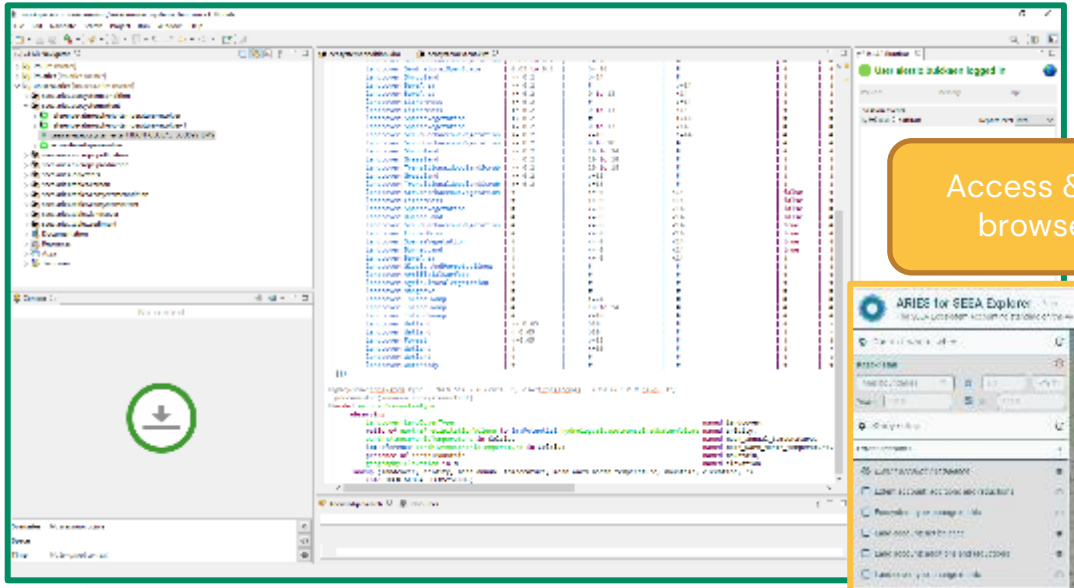
Users who want to create evaluations and explore defined scenarios.
Only a current web browser is needed, such as Chrome or Firefox to use the online tool called **k.Explorer** (the general k.LAB interface to explore by querying the knowledge base) to access k.LAB's linked data and models.

Technical users

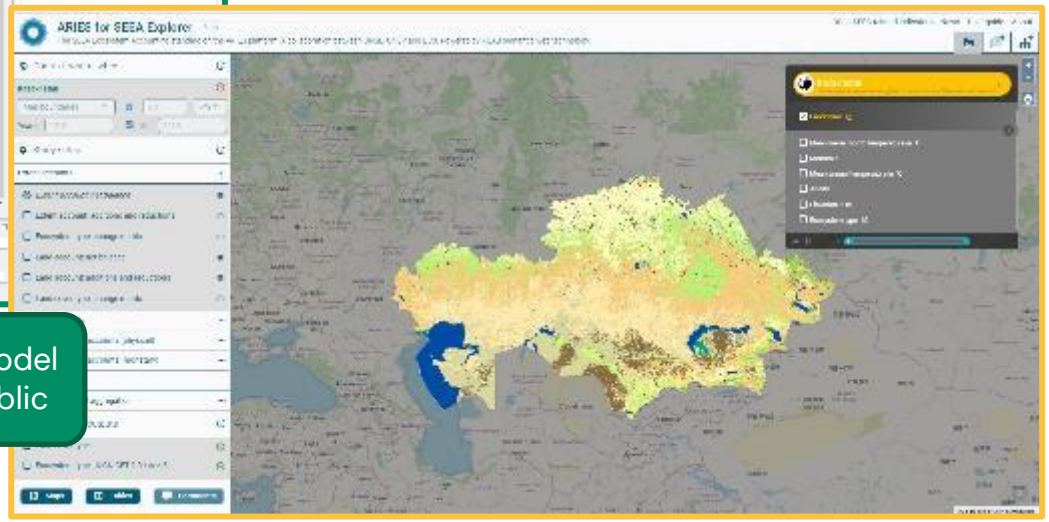
Users who want to produce data and model.
You'll need specialized tools to import, annotate, and publish data and models on the k.LAB semantic web. You have to install the Control Center software package which includes:

- The local engine (**k.LAB engine**) and its web-based user interface (**k.Explorer**)
- The Integrated development environment (**k.Modeler**)

Interfaces for technical and non-technical users



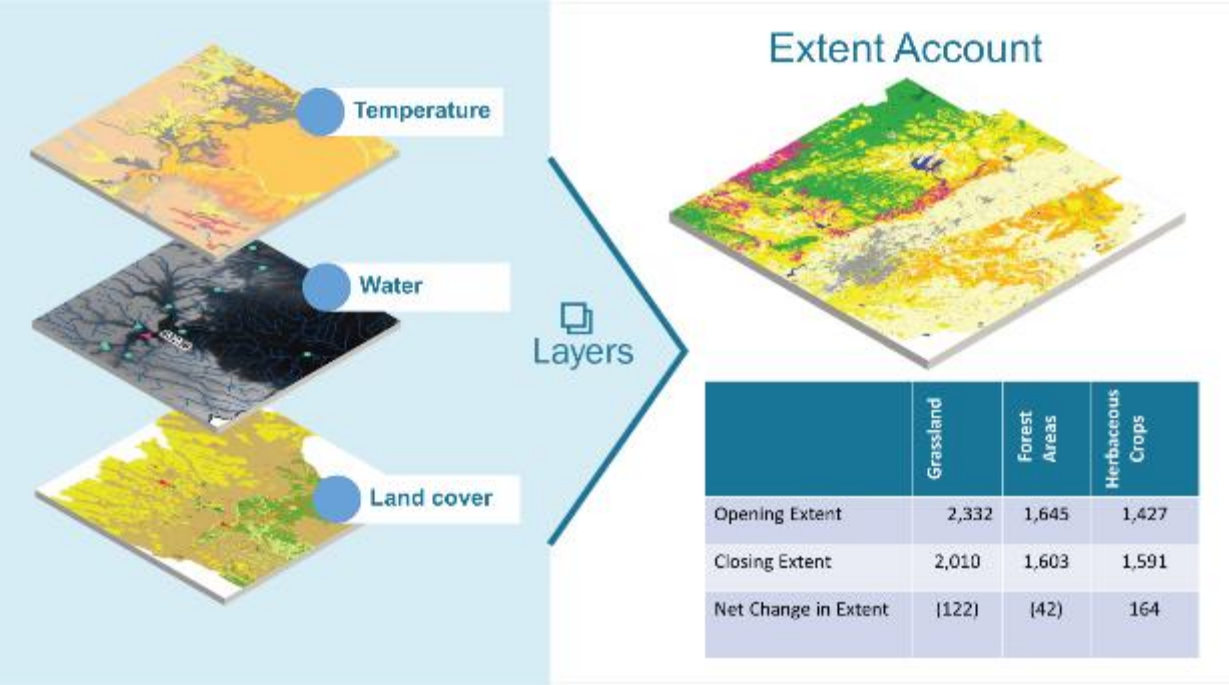
Access & run scientific models in minutes through a web browser, using cloud-based data, anywhere on Earth



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

ARIES for SEEA: Ecosystem Type

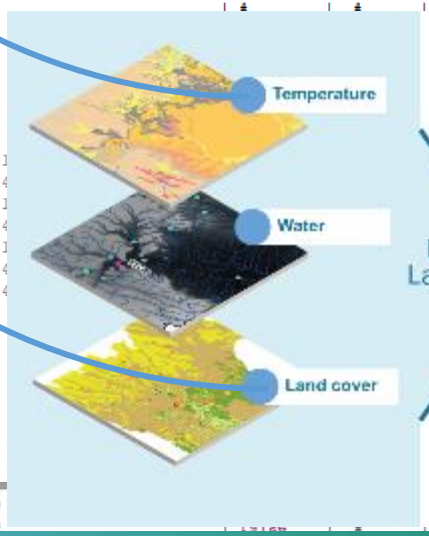
Ecosystem Type modeling



	Grassland	Forest Areas	Herbaceous Crops
Opening Extent	2,332	1,645	1,427
Closing Extent	2,010	1,603	1,591
Net Change in Extent	(122)	(42)	164

Ecosystem Type modeling

```
define IUCN_GLOBAL_ECOSYSTEMS as {{
        landcover                                | aridity      | mean_annual_temperature | mean_warm_month_temperature | mountain | elevation | ecosystem_type
    ------------------------------------------------------------------------------------------------------------------------------------------------------------------
        landcover:Forest                         | >= 0.65      |      >= 18              |   #                         | false    |   #       | es.nca:TropicalSubtropicalLowlandRainforest ,
        landcover:Forest                         | >= 0.65      |      >= 18              |   #                         | unknown  |   #       | es.nca:TropicalSubtropicalLowlandRainforest ,
        landcover:Forest                         | 0.05 to 0.65 |      >= 18              |   #                         |   #      |   #       | es.nca:TropicalSubtropicalDryForestThicket ,
        landcover:Forest                         | >= 0.65      |      >= 18              |   #                         | true     |   #       | es.nca:TropicalSubtropicalMontaneRainforest ,
        landcover:Forest                         |   #          |      <= 0               |   #                         |   #      |   #       | es.nca:BorealTemperateMontaneForestWoodland ,
        landcover:Forest                         |   #          |      0 to 18            |   #                         | true     |   #       | es.nca:BorealTemperateMontaneForestWoodland ,
        landcover:Forest                         |   #          |      0 to 18            |   #                         |   #      |   #       | es.nca:TemperateForest ,
        landcover:ScrubHerbaceousVegetation      | 0.03 to 0.2  |      0 to 10            |   #                         |   #      |   #       | es.nca:CoolDesertSemidesert
        landcover:SeminaturalOpenSpace           | 0.03 to 0.2  |      0 to 10            |   #                         |          |           |
        landcover:ScrubHerbaceousVegetation      | <= 0.03      |      > 0                |   #                         |          |           |
        landcover:SeminaturalOpenSpace           | <= 0.03      |      > 0                |   #                         |          |           |
        landcover:ScrubHerbaceousVegetation      | 0.03 to 0.2  |      >= 10              |   #                         |          |           |
        landcover:SeminaturalOpenSpace           | 0.03 to 0.2  |      >= 10              |   #                         |          |           |
        landcover:Shrubland                      | >= 0.2       |      >= 24              |   #                         |          |           |
        landcover:BareArea                       | >= 0.2       |      #                  |   >= 1                      |          |           |
        landcover:BareArea                       | >= 0.2       |      0 to 13            |   < 14                      |          |           |
        landcover:LichenMoss                     | >= 0.2       |      #                  |   >= 1                      |          |           |
        landcover:LichenMoss                     | >= 0.2       |      0 to 13            |   < 14                      |          |           |
        landcover:SparseVegetation               | >= 0.2       |      #                  |   >= 1                      |          |           |
        landcover:SparseVegetation               | >= 0.2       |      0 to 13            |   < 14                      |          |           |
        landcover:ScrubHerbaceousVegetation      | >= 0.2       |      <= 10              |   >= 4                      |          |           |
        landcover:ScrubHerbaceousVegetation      | >= 0.2       |      0 to 10            |   #                         |          |           |
        landcover:Shrubland                      | >= 0.2       |      10 to 24           |   #                         |          |           |
        landcover:Grassland                      | >= 0.2       |      10 to 18           |   #                         |          |           |
        landcover:TransitionalWoodlandScrub      | >= 0.2       |      10 to 18           |   #                         |          |           |
        landcover:Grassland                      | >= 0.2       |      >=18               |   #                         |          |           |
        landcover:TransitionalWoodlandScrub      | >= 0.2       |      >=18               |   #                         |          |           |
        landcover:ScrubHerbaceousVegetation      |   #          |      <= 0               |   < 14                      |          |           |
        landcover:LichenMoss                     |   #          |      <= 0               |   < 14                      |          |           |
```



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Useful links:

- ARIES for SEEA | System of Environmental Economic Accounting
- ARIES - ARtificial Intelligence for Environment & Sustainability | ARtificial Intelligence for Environment & Sustainability (integratedmodelling.org)
- https://aries.integratedmodelling.org/collaborate/
  - Links to wiki / confluence pages
  - Getting started with k.LAB (integratedmodelling.org) [videos]