

A satellite night view of Europe, showing the continent illuminated by city lights against the dark background of the night sky and the blue glow of the Earth's atmosphere.

EU-wide datasets & information systems for ecosystem accounting

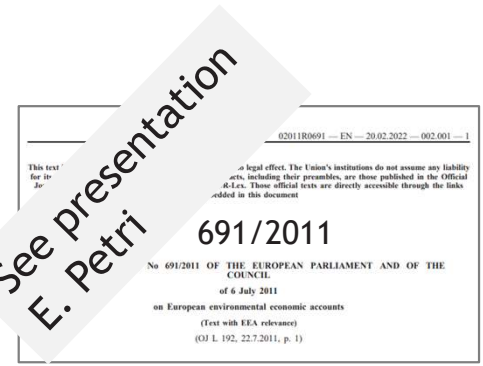
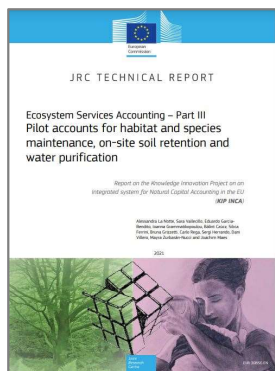
Bruno Smets

Contributions by Marcel Buchhorn, Thomas Danckaert, Maarten Van Loo, Wim Peelaerts, Steven Broekx

MAIA Final Project Conference, Brussels



Support mainstream of NCA in Europe



See presentation
E. Petri

Support in INCA Phase-3

vito + Ecounting + IDEEA Group + eftec

1. EU methodological Guidelines
2. INCA Account Tool
3. Validation Methods
4. Demo policy use

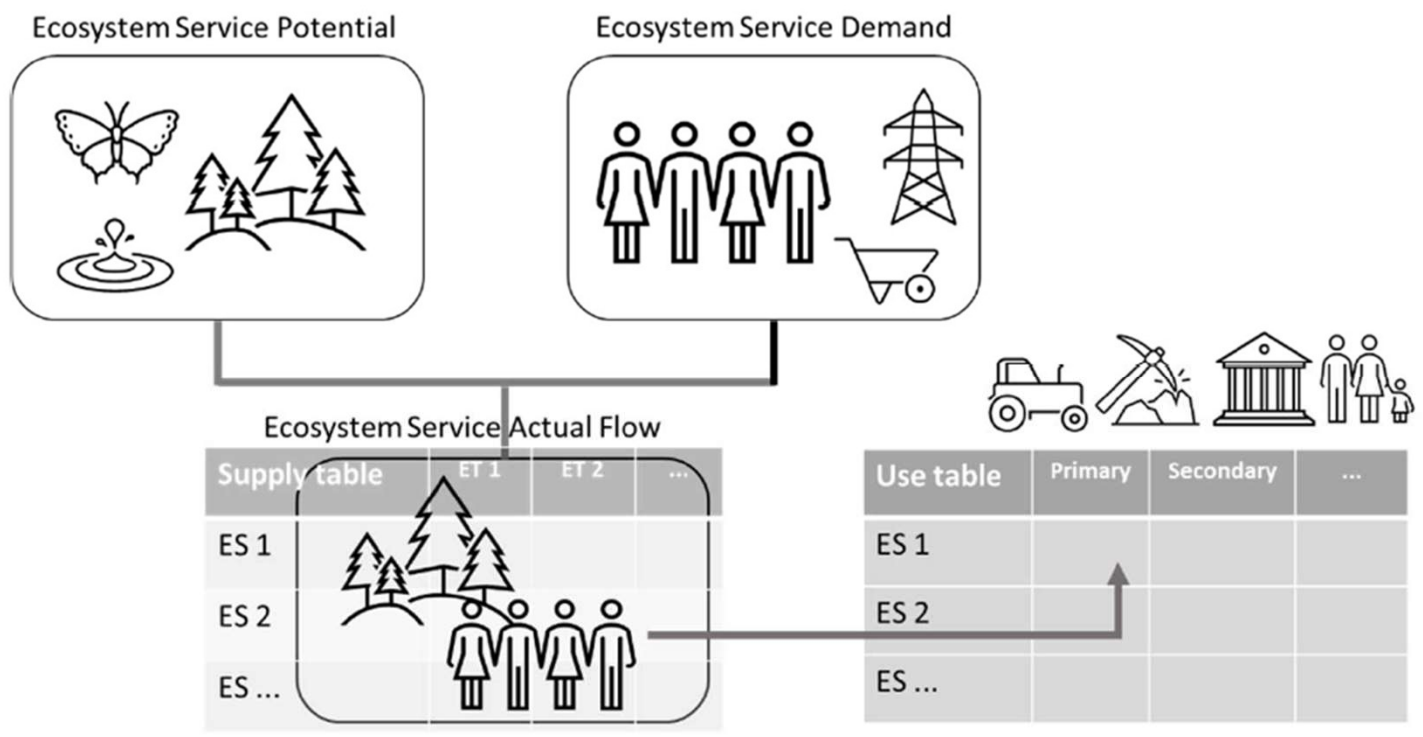
- Unified & Harmonized
- Service accounts
- Multi-user types
- Feedback loop
- National & EU
- Open source

EU or National data-sets





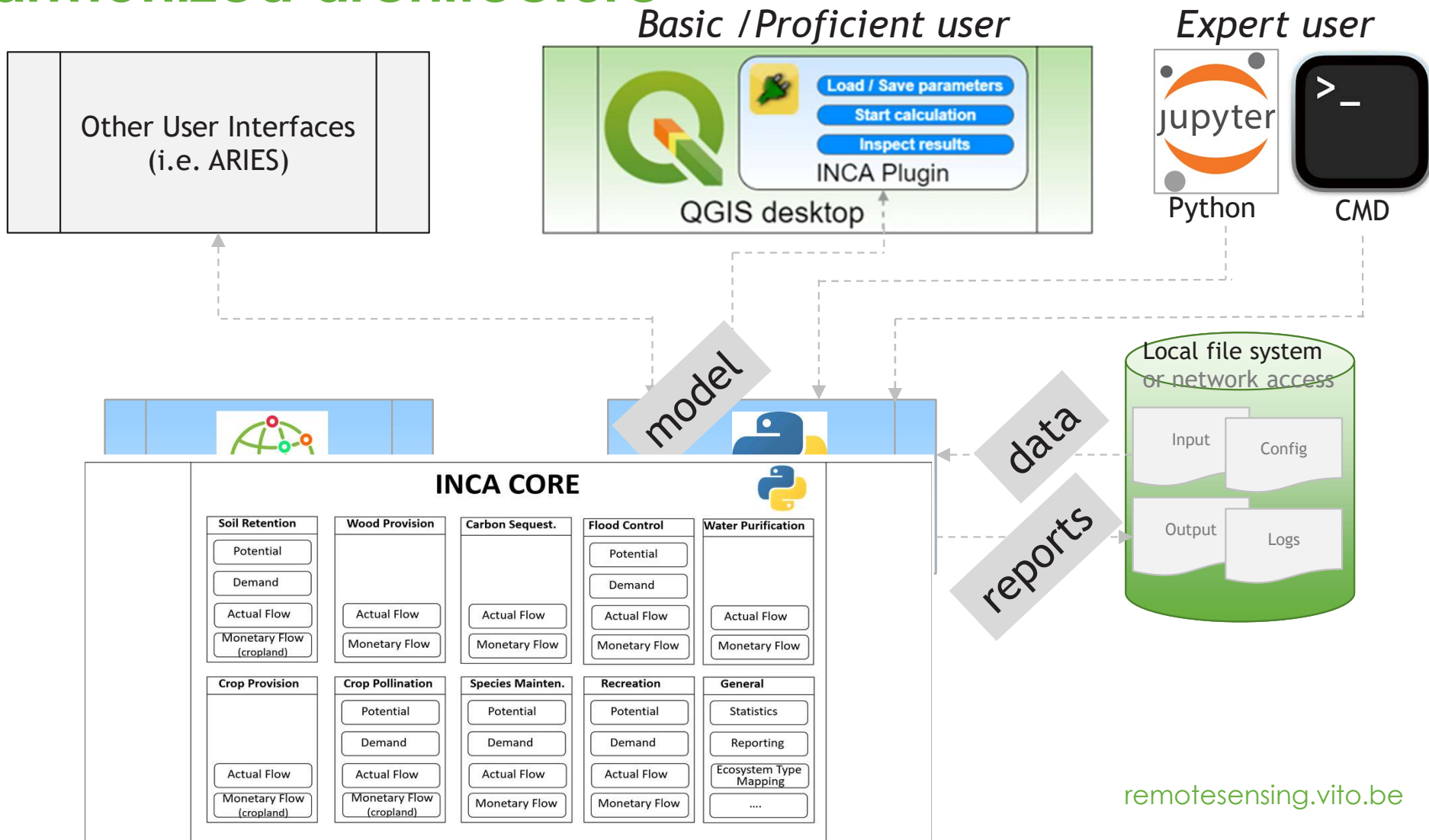
Conceptual model of the INCA tool



La Notte A., et.al 2021, *Ecosystem Service Accounting - Part III - Pilot Accounts*



Harmonized architecture





Models & reports : from pilot to fair



Findability

- DOI for algorithm model
- Rich Metadata annotation (production date, units, used inputs, etc.)

Accessibility

- Free and open source published under EUPL (early 2023)
- Installation, user and developer manuals
- Basic to proficient to expert users
- Able to run on a normal PC to upscaled on high-end machines (cloud, multi-core)

Interoperability

- Compliant to SEEA EA & EU guidelines
- Common API (INCA architecture)
- Harmonized reporting across EU (cog, csv, xlsx templates)
- Tested on Linux and Windows

Reusability

- Modular standard design, easy to add new services
- Modular design, enables integration in different platforms



Data input

- **Linkage table (#121 rows)**

- Temporal resolution
- INCA Component

- **Complex pre-processing**

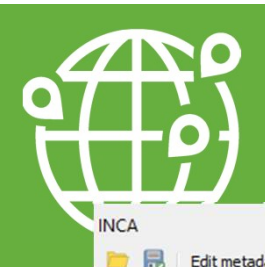
- Mix tabular, raster, vector
- AOI & Spatial resolution
- Projection



- **Configurable for MS**

- DataArea vs. ReportingArea
- Default EU vs. Specific MS

ECOSYSTEM SERVICE	INPUT DATA - LONG NAME	INPUT DATA - SHORT NAME	INPUT YEAR	OUTPUT COMPONENT	OUTPUT YEAR
crop pollination	Unit values at basic prices [aact_uv01]	basic_prices	2017, 2018, 2019	monetary evaluation	2018
crop pollination	CAPRI crop pollination dependent crops (demand) & total	CAPRI demand	2004	demand	2000
crop pollination	CAPRI crop pollination dependent crops (demand) & total	CAPRI demand	2008	demand	2006, 2012, 2018
crop pollination	CAPRI crop specific total production	CAPRI production	2004	use	2000
crop pollination	CAPRI crop specific total production	CAPRI production	2008	use	2006, 2012, 2018
crop pollination	deflator table	deflator_table	static	monetary evaluation	2000, 2006, 2012, 2018
species maintenance	habitats_maes	habitats_maes.csv	static	Article T7 spatial data	2000, 2006, 2012, 2018
species maintenance	Habitats_regions_MS_2nd_assessment	Habitats_regions_MS_2nd_assessment_rav.csv	static	Article T7 spatial data	2000, 2006, 2012, 2018
species maintenance	Structure and function assessment (Article T7 spatial data)	artT7_habitat_uniq_diselv.shp	static	Article T7 spatial data	2000, 2006, 2012, 2018
species maintenance	Accounting CORINE Land-cover v20	CLC2000ACC_V<YEAR>_20.tif	2000, 2006, 2012, 2020	Potential, extens fractions	2000, 2006, 2012, 2018
species maintenance	10 by 10 km grid for europe	Grid_10km.shp	static	Potential, extens fractions	2000, 2006, 2012, 2018
species maintenance	Hign Nature Values map in europe	HNVacc_v20b_BaseLayer_CY_EAR.tif	2000, 2006, 2012, 2018	Potential	2000, 2006, 2012, 2018
species maintenance	Mineral nitrogen in soil map europe	NRINSL_C<YEAR>_10km_lookout.tif	2000, 2006, 2012, 2018	Potential	2000, 2006, 2012, 2018
species maintenance	Imperviousness map europe	IMD_C<YEAR>_100m_eu_03035_d03_full.tif	2000, 2006, 2012, 2018	Potential	2000, 2006, 2012, 2018
species maintenance	Hotspot map	Allsp_hotspot.tif	2000, 2006, 2012, 2018	Potential	2000, 2006, 2012, 2018
species maintenance	JRC species valuation data	Calculating the totals 2012.xlsx	2000, 2006, 2012, 2018	potential, demand, mismatch	2000, 2006, 2012, 2018
Recreation	Global Human Settlement Layer	GHSL	2000, 2015	demand	2000, 2006, 2012, 2018
Recreation	Eurostat population	functional_population	2000, 2012	demand	2000, 2006, 2012, 2018
Recreation	Nature based recreation supply - euro per capita	Use tables	2000, 2012	Use	2000, 2006, 2012, 2018
Recreation	Nature based recreation use - euro per capita	Supply tables	2000, 2012	Use	2000, 2006, 2012, 2018
Recreation	Nature based recreation supply - million euro	Use tables	2000, 2012	Use	2000, 2006, 2012, 2018
Recreation	Nature based recreation use - million euro	Supply tables	2000, 2012	Use	2000, 2006, 2012, 2018
Recreation	Nature based recreation supply - visits	Use tables	2000, 2012	Use	2000, 2006, 2012, 2018
Recreation	Nature based recreation use - visits	Supply tables	2000, 2012	Use	2000, 2006, 2012, 2018
Recreation	Nature based recreation demand	Demand tables	2000, 2012	Demand	2000, 2006, 2012, 2018
Recreation	Nature based recreation unmet demand	Mismatch tables	2000, 2012	Mismatch	2000, 2006, 2012, 2018
Recreation	Nature based recreation potential	Potential tables	2000, 2012	Potential	2000, 2006, 2012, 2018
Crop Provision	CAPRI crop yield raster	Proxy	static	Use	2000, 2006, 2012, 2018
Crop Provision	Crop production in EU standard humidity [apro_spph1]	production	11, 2012, 2013, 2017, 2018	Use	2000, 2006, 2012, 2018
Crop Provision	Unit values at basic prices [aact_uv01]	basic_prices	1997-2017	Use	2000, 2006, 2012, 2018
Crop Provision	deflator table	deflator_table	2000, 2006, 2012, 2018	Use	2000, 2006, 2012, 2018
Crop Provision	Ecosystem contribution factor table	ecoscon	static	Use	2000, 2006, 2012, 2018
Crop Provision	NUTS classification (Nomenclature of territorial units for statistics)	NUTS	2021	Use	2000, 2006, 2012, 2018
Timber Provision	NUTS classification (Nomenclature of territorial units for statistics)	NUTS	2021	Use	2000, 2006, 2012, 2018
Timber Provision	deflator table	deflator_table	2000, 2006, 2012, 2018	Use	2000, 2006, 2012, 2018
Timber Provision	Net annual increment of forest available for wood supply	NAL_FAVIS	2000-2015	Use	2000, 2006, 2012, 2018
Timber Provision	Roundwood, fuelwood and other basic products [for_basic]	for_basic	2000-2019	Use	2000, 2006, 2012, 2018
Timber Provision	Supply and use of products within forestry [for_sup_op]	for_sup_op	2000-2019	Use	2000, 2006, 2012, 2018
Timber Provision	Natura 2000 areas	n2k	2000, 2006, 2012, 2018	Use	2000, 2006, 2012, 2018
Timber Provision	Dry matter production v2.0.1	DMP	2000, 2006, 2012, 2018	Use	2000, 2006, 2012, 2018
Timber Provision	Accounting CORINE Land-cover v20	CLC	2000, 2006, 2012, 2018	Use	2000, 2006, 2012, 2018
Timber Provision	Copernicus DEM	DEM	static	Use	2000, 2006, 2012, 2018
Flood Control	Copernicus DEM	DEM	static	Potential, Supply, Use	2000, 2006, 2012, 2018
Flood Control	Accounting CORINE Land-cover v20	CLC	2000, 2006, 2012, 2018	Potential, Demand, Use, Value	2000, 2006, 2012, 2018
Flood Control	Hydrological soil properties (reclassified in 4 categories)	hydro_soil	static	Potential	2000, 2006, 2012, 2018
Flood Control	Imperviousness map europe	IMD	2006, 2012, 2018	Potential	2000, 2006, 2012, 2018
Flood Control	OpenStreetmap main and secondary roads	osm_roads	static	Potential, Demand, Use, Value	2000, 2006, 2012, 2018
Flood Control	Riparian zones	riparian_zones	static	Potential	2000, 2006, 2012, 2018
Flood Control	Global Human Settlement Layer	ghs_pop	2000, 2015	Population use/demand/mismatch	2000, 2006, 2012, 2018



Example tourism recreation @ DE

INCA

Edit metadata | Run | Continue existing run

Working directory: C:\Data\INCA\BETA2

Study Scope

Year: 2018

Region shapes: 2021 EU members [NUTS 2021 level 0]

Selected regions: DE

Land cover map: INCA-AOI_100m\LandCover_Corine_INCA-AOI\CLC2018ACC_V2018_20_INCA_100m_EPSG3035.tif

Land classification: INCA default mapping for CORINE data

Ecosystem Service Recreation

Run name: recreation_default2_DE

NUTS-2 regions: CA\input_model_recreation\input_model\NUTS_RG_01M_2016_3035_LEVL_2.shp

Overnight stays: C:\Data\INCA\input_model_recreation\input_model\overnight_stays_2018.csv

Eco contribution per type of Area: CA\input_model_recreation\input_model\default2\typeAreaContributionTable.csv

Eco contribution per Area: CA\input_model_recreation\input_model\default2\dataAreaContributionTable.csv

Ecosystem type weights: INCA default ecosystem weights

Accessibility map: ata\INCA\input_model_recreation\input_model\default2\ros_jrc_reclass_2018.tif

Accessibility weights: Use map values as weights.

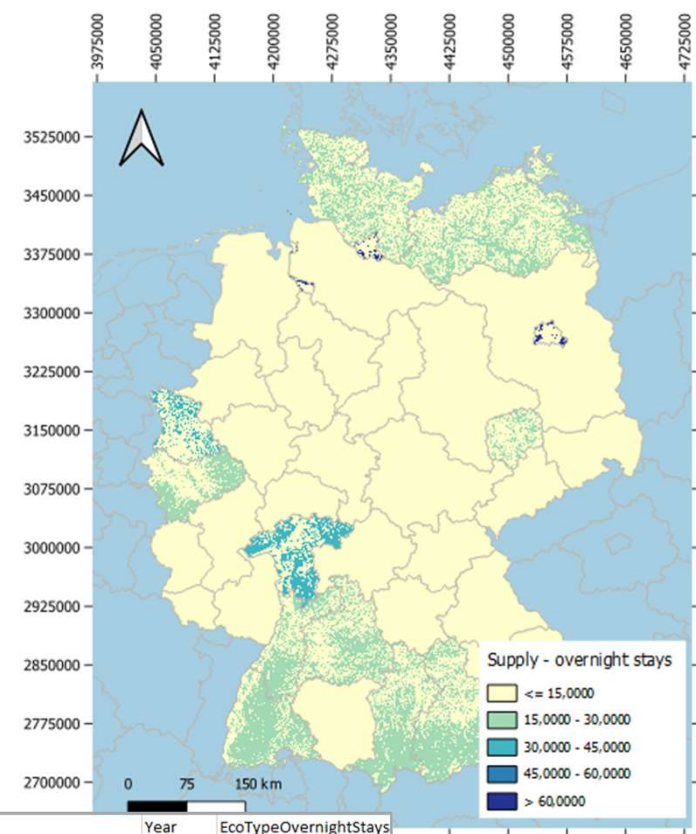
Facilities map: ata\INCA\input_model_recreation\input_model\default2\ros_jrc_reclass_2018.tif

Facility weights: Use map values as weights.

Landscape attractiveness map: ata\INCA\input_model_recreation\input_model\default2\ros_jrc_reclass_2018.tif

Landscape attractiveness weights: Use map values as weights.

Map



Supply

ReportAreaCode	EcosystemType	Year	EcoTypeOvernightStays
0 DE	Settlements and other artificial areas	2018	0
1 DE	Cropland	2018	0
2 DE	Grassland (pastures, semi-natural and natural grassl	2018	96845358
3 DE	Forest and woodland	2018	144820176
4 DE	Heathland and shrub	2018	1049226
5 DE	Sparsely vegetated ecosystems	2018	296595
6 DE	Inland wetlands	2018	1862373
7 DE	Rivers and canals	2018	2289975
8 DE	Lakes and reservoirs	2018	6496776
9 DE	Marine inlets and transitional waters	2018	0
10 DE	Coastal beaches, dunes and wetlands	2018	495749
11 DE	Marine ecosystems (offshore coastal shelf and open	2018	0

Use

ReportAre	UseSector	Year	EcoOvernightStays
0 DE	Exports	2018	51874981
1 DE	Household final consu	2018	202281245





INCA Accounts series extended to 2018 using tool

INCA Platform

Home About INCA Publications News Data Catalogue Map Tool Glossary Contact Us

How ecosystem services are assessed in INCA

Ecological side Socio-economic side

Ecosystem Service use

Match Mis-match

Ecosystem services map tool

START

Accounting tables
-- Select --

Complementary tables
-- Select --

News

Ecosystem extent (EEA)
Extent of ecosystem types -- Select --

Ecosystem condition
State and trends of quality of ecosystem -- Select --

About INCA

INCA addresses key policy objectives of the EU's 7th Environment Action Programme and the EU Biodiversity Strategy to 2020.

READ MORE

Publications

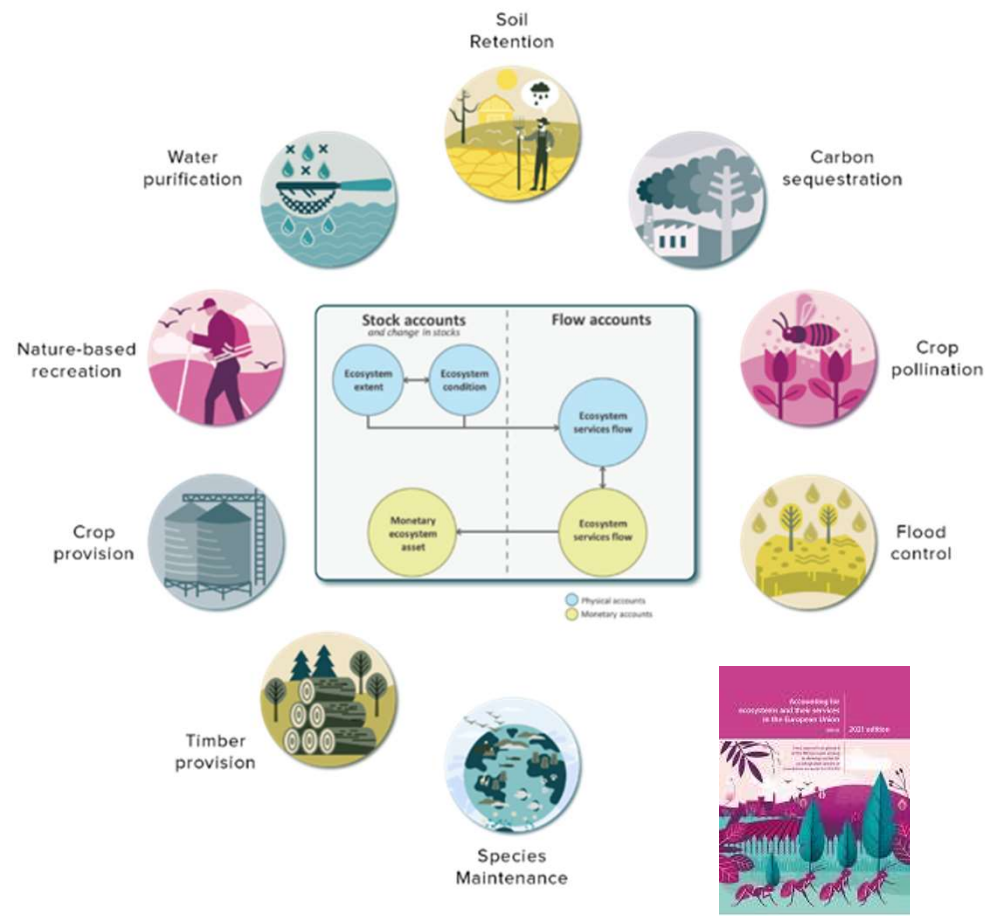
Reports, scientific articles and technical documentation produced by the INCA project.

SEE MORE

Data catalogue

The data catalogue allows browsing the input and output datasets of the different ecosystem services.

EXPLORE

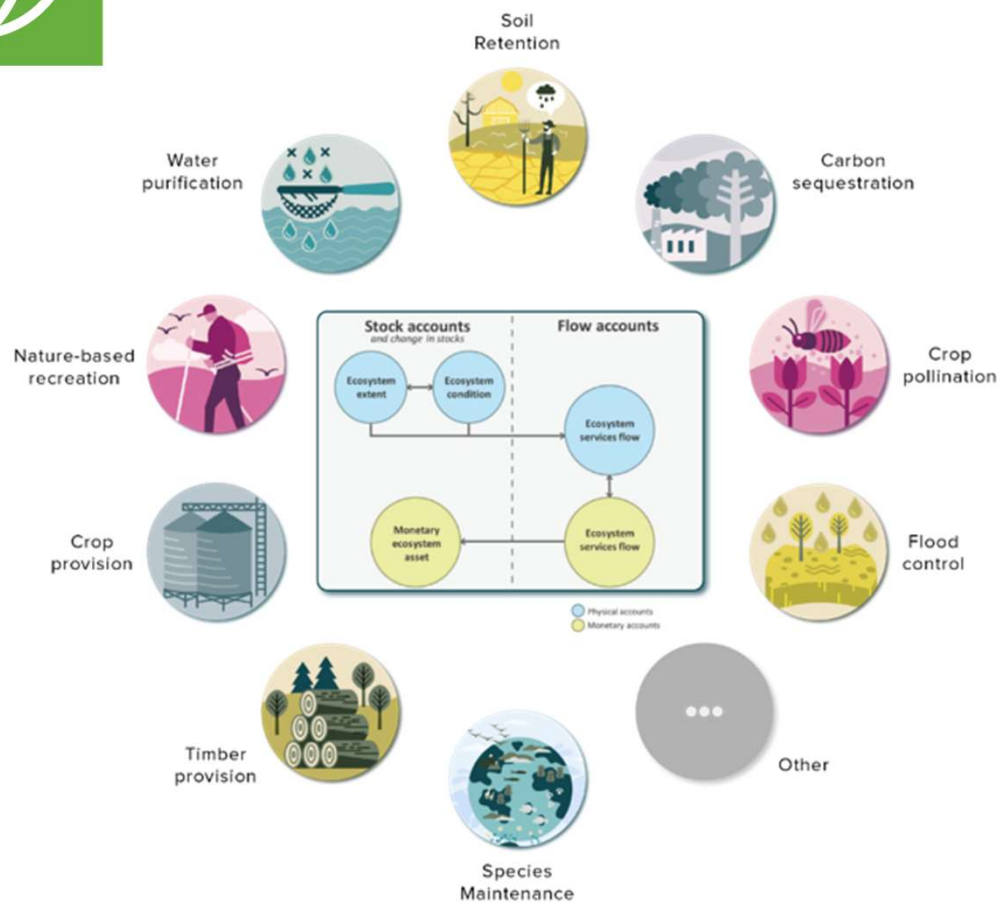


<https://ecosystem-accounts.jrc.ec.europa.eu/>

remotesensing.vito.be



Services in INCA tool



	Service	EU-2018*	EU-2021*
Provisioning	Wood provision	A	P
	Crop provision	A	P
	Crop pollination	A	P
Regulating	Soil Retention	A	P
	Air filtration		P
	Global climate regulation	A	P
	Local climate regulation		P
	Water purification	A	
	Flood control	A	P
	Species maintenance	A	
Cultural	Nature-based	A	P
	Tourism-based		P

1.0 (end 2022)

2.0 (end 2023)

*: series from 2000

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You want to know more ...

TRANSITION TO A SUSTAINABLE PLANET THROUGH NATURAL CAPITAL ACCOUNTING

Our economy and our human well-being highly depend on nature and its "services". Longley, we underestimated these services, but the recent COVID-19 pandemic - disrupting economies, societies and livelihoods around the entire globe - emphasized that **nations have to speed up their transition to "Green Stimulus", Economic Recovery and Long-Term Sustainable Development**. Otherwise we cannot restore employment and boost economic growth in sustainable manner. But we don't need traditional recovery efforts, we need conscious leadership and prioritize recovery efforts that are green, inclusive and resilient for future well-being. **Natural Capital Accounting (NCA) or ecosystem accounting can support the acceleration towards this new sustainable planet**. Discover more about NCA and the geospatial methodologies and tools we develop to ease and accelerate this transition at multi-scale.

A story about Biodiversity, SDG's, Geospatial, Natural Capital Accounting, Ecosystem services by Bruno Smets 16.01.2022

<https://blog.vito.be/remotesensing/accelerating-nca>



TREND MD

Short Communication

One Ecosystem 7: e85389
<https://doi.org/10.3897/oneeco.7.e85389> (24 Aug 2022)

Establishing a reference tool for ecosystem accounting in Europe, based on the INCA methodology

▼ Marcel Buchhorn, Bruno Smets, Thomas Danckaert, Maarten van Loo, Steven Broekx, Wim Peelaerts

Abstract ▲

The European Commission developed an amendment to Regulation 691/2011 on European environmental economic accounts to include reporting on ecosystem accounts compliant to the United Nations Statistical Commission System of Environmental-Economic Accounts – Ecosystem Accounts (SEEA-EA) standard. To support Member States implementing this regulation, an open source tool, known as INCA-tool, to generate ecosystem service accounts has been developed, based on the Knowledge Innovation Project on Integrated Systems of Natural Capital and Ecosystem Services Accounting (KIP-INCA) methodologies. The INCA-tool was developed by taking into account the FAIR principle for software and data, as well as existing interoperability standards by the SEEA community. Three types of users were identified with their specific needs, interactions and skills. To meet their needs, the INCA-tool was split into two parts, a python package to perform the calculations and an accessible and easy-to-use user interface in QGIS to integrate national information. With a first version of the toolkit in place, improvements to the existing calculation methods and alignment with the upcoming EU regulation can be achieved. Further, feedback from Member States beta-tests and their experiences is currently collected and implemented and the full public roll-out is planned for the end of 2022. The software packages in the toolkit were already used to extend the existing nine INCA European wall-to-wall account series with the year 2018.

<https://oneecosystem.pensoft.net/article/85389/>

remotesensing.vito.be



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User Requirements for INCA tool

Type of User	Needs	Tool interaction	Required skills
Basic User	Only source for national accounts / Cross validation of national models	Consultation and use of final results at national level (tabular data)	Consultation and processing of tabular data (e.g. MS Excel)
Proficient User	Starting point to develop improved national accounts	Operate the tools on a national level and replace input data with national data sources	Consultation and processing of spatial data (e.g. GIS software – QGIS, ArcGIS)
Expert User	Starting point to develop national accounting procedures and perform R&D (e.g. JRC)	Operate the tools to replace formulas (open source code) and input data	Programming skills (e.g. python, ...)



Example soil retention – CORE module

