Evidencing Earth Observation Use in INCA Ecosystem Accounts

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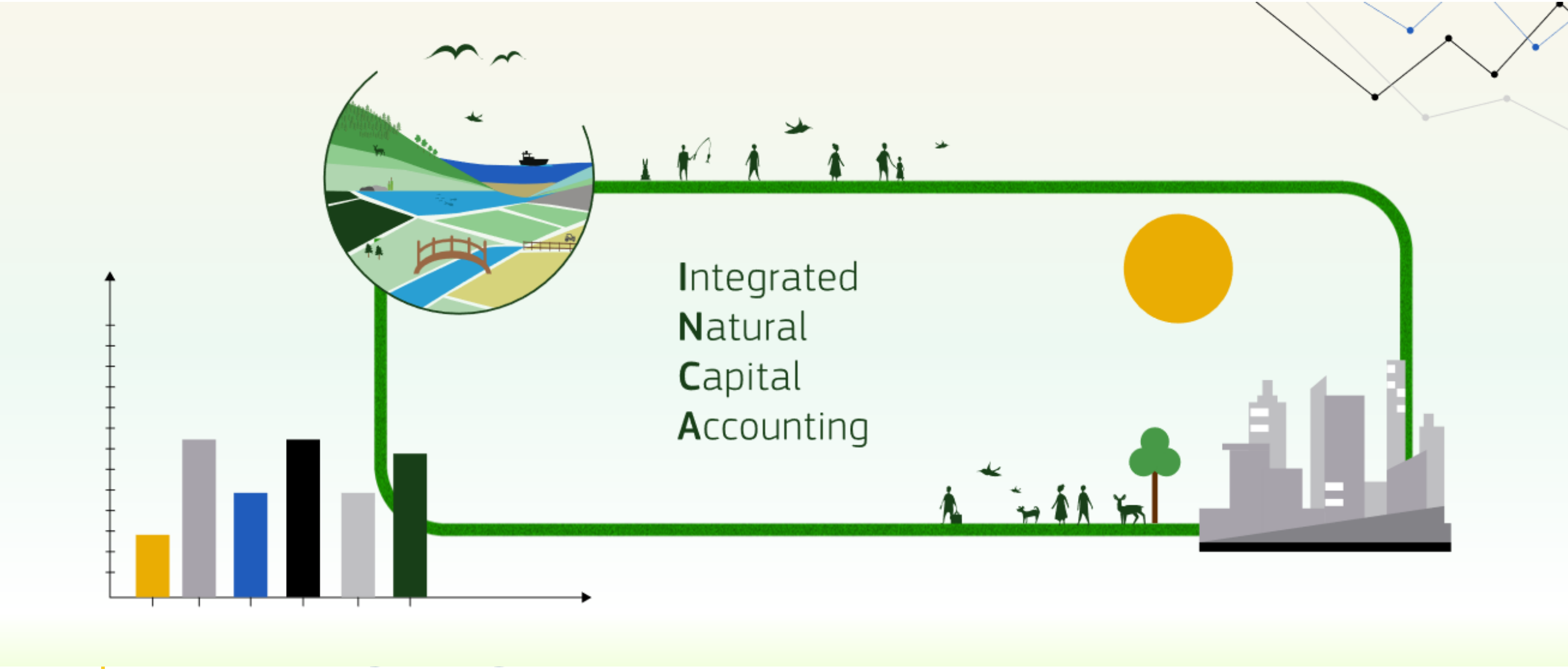
International Workshop on Earth Observation for SEEA compliant Natural Capital Accounting

Electra Palace Athens

23rd May 2024

INCA operationalises the SEEA EA



Currently* 8 ecosystem services accounts models

- Global climate regulation
- Local climate regulation
- Air filtration (PM10)
- Flood control
- Crop provision
- Wood provision
- Soil retention
- Nature-based tourism
- Crop pollination (coming soon)

5 models are based on Earth Observation

- Global climate regulation
- Local climate regulation
- Air filtration (PM10)
- Flood control
- Crop provision
- Wood provision
- Soil retention
- Nature-based tourism
- Crop pollination (coming soon)

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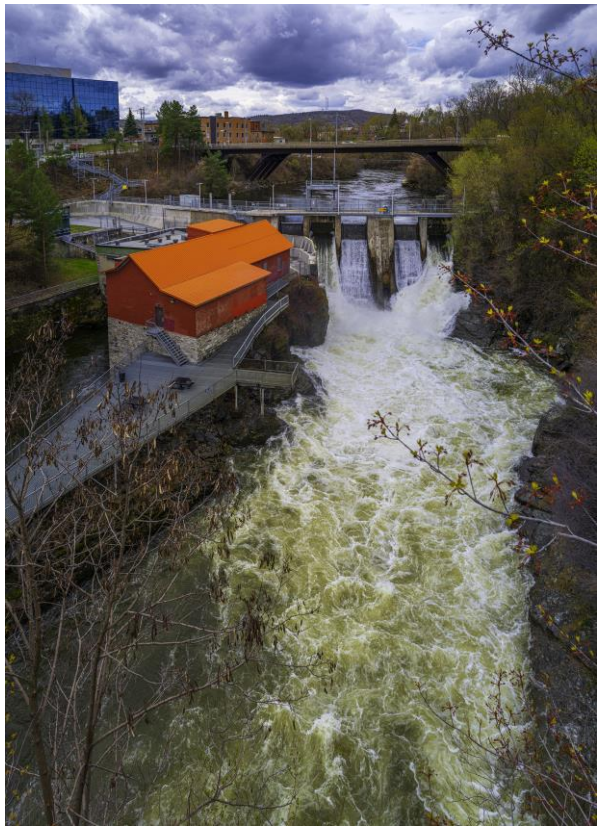
Focus on flood control

- Global climate regulation
- Local climate regulation
- Air filtration (PM10)
- **Flood control**
- Crop provision
- Wood provision
- Soil retention
- Nature-based tourism
- Crop pollination (coming soon)



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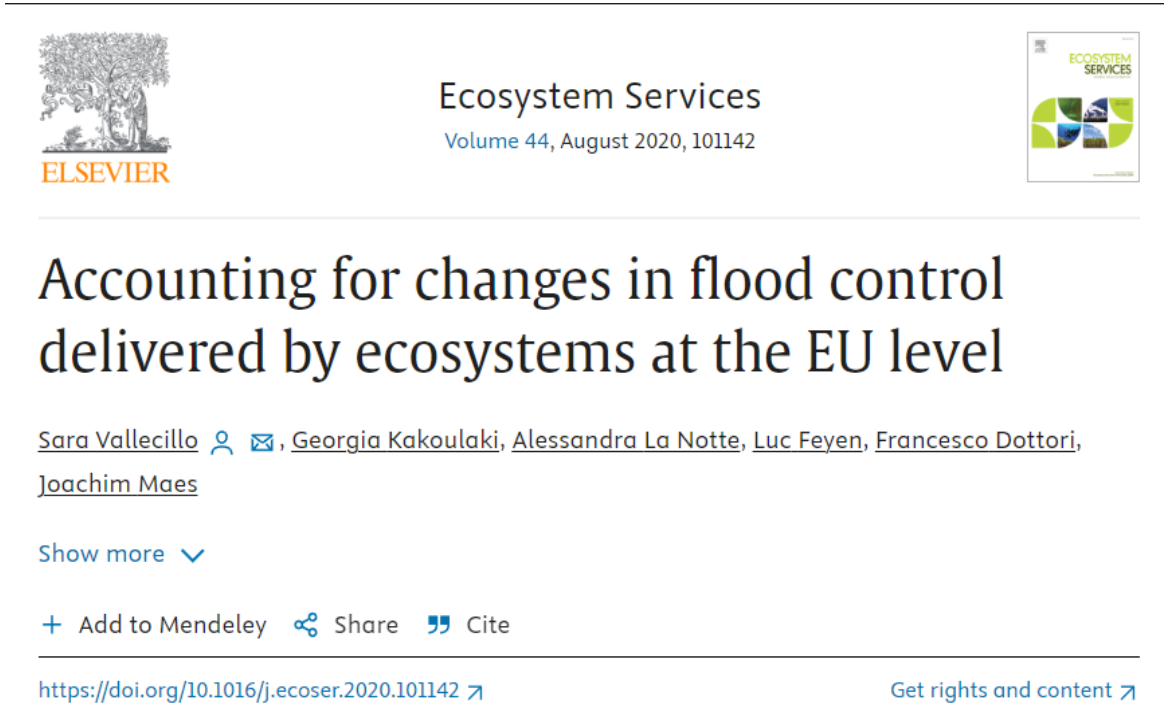
Flood control

The regulation of water flow by ecosystems that mitigates or prevents potential damage to economic assets (i.e., infrastructure, agriculture) and human lives.



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Accounting for changes in flood control delivered by ecosystems at the EU level

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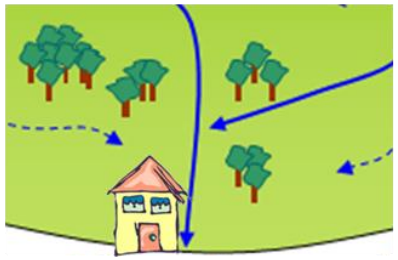
Flood control: conceptual framework (MAES)

Accounting tables

Service flow of flood control



Extent of **demand** protected by upstream **ecosystems**

Spatial relationship: **slope-dependent**

Flood control **POTENTIAL**

Runoff retention by ecosystems

Service Providing Areas (SPA)

DEMAND for flood control

Economic assets in floodplains

Service Demanding Areas (SDA)

European Commission

Indicators for flood control potential

Curve number scoring for land cover classes

USDA Soil Conservation Service

Adjustments to the Curve Number

CN Score: capacity to produce runoff

Land cover classes + Soil Type

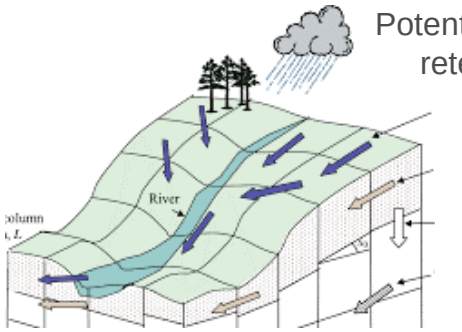
- Sandy soil: - runoff
- Clay soil: + runoff

+ runoff

- runoff

Curve number lookup table for the EU available for CLC & CLC+

Flood control potential with CLC (100m)



Potential runoff retention

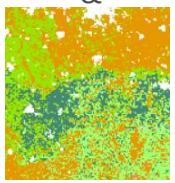
Runoff generated

Curve number scoring

Hydrologic soil group + land cover

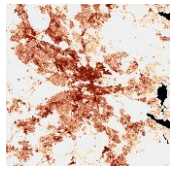
CLC

&



ESDAC soil texture classes

Correction by imperviousness



HRL imperviousness

Adjustment by slope

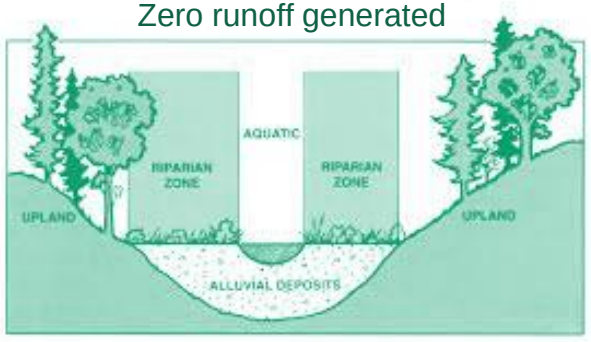
Derived from DEM

Semi-natural land covers riparian zones

Riparian zones

Reversal of CN scores = potential runoff retention

Zero runoff generated



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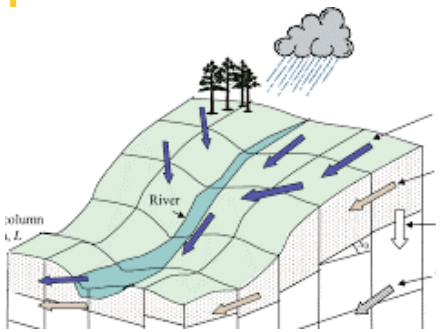
Flood control potential with CLC+ (25m)

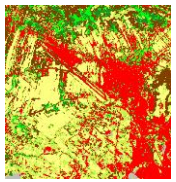


Potential runoff retention

Runoff generated

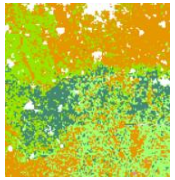
Curve number scoring for CLC+

Hydrologic soil group + land cover



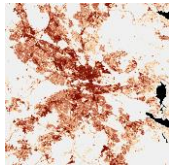
CLC+

&



ESDAC soil texture classes

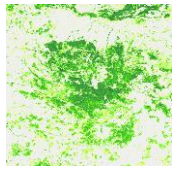
Correction by imperviousness



HRL imperviousness

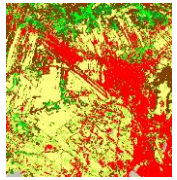
New development

Tree cover density correction



HRL tree cover density

&



CLC+

Tree canopy cover is a condition indicator for the NRL

Adjustment by slope

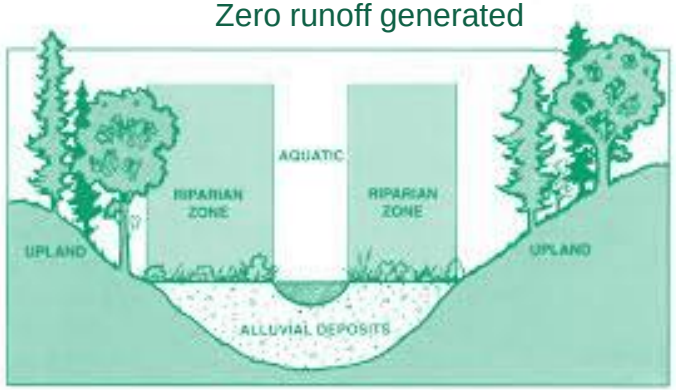
Derived from DEM

Semi-natural land covers riparian zones

Riparian zones

Reversal of CN scores = potential runoff retention

Zero runoff generated



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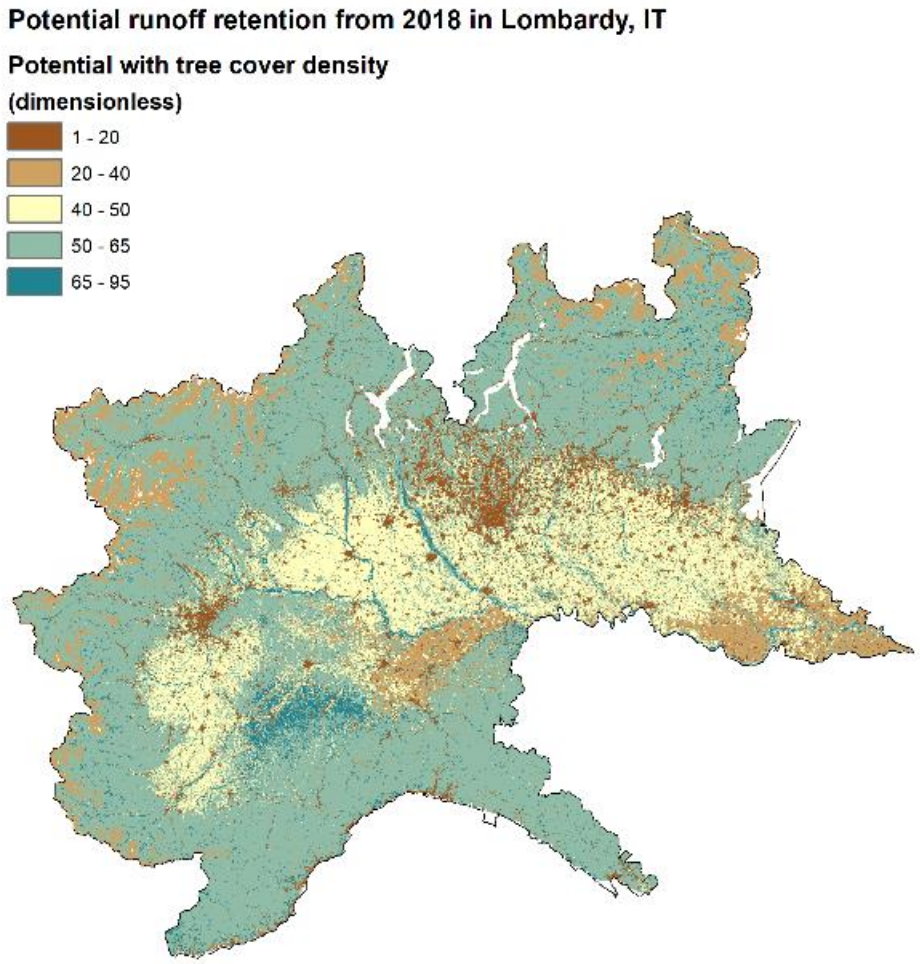
Flood control potential equations

1. $$CN_{imp} = 98 * \frac{Imp}{100} + \left(1 + \frac{Imp}{100}\right) * CN_{CLC}$$

2. $$CN_{TCD} = \begin{cases} CN_{forest} = 36 * \left(1 - \frac{TCD}{100}\right) + \frac{TCD}{100} * CN_{imp} \\ CN_{others} = 20 * \left(\frac{TCD}{100}\right) + \left(1 - \frac{TCD}{100}\right) * CN_{imp} \end{cases}$$

3. $$CN_{slope} = CN_{TCD} * \frac{322.79+15.63(slope)}{slope+323.52}$$

Potential runoff retention with TCD adjustment



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Potential runoff retention to Service Providing Areas (SPAs)

Potential runoff retention

Service providing areas (SPA)

Flood control potential = extent of SPA

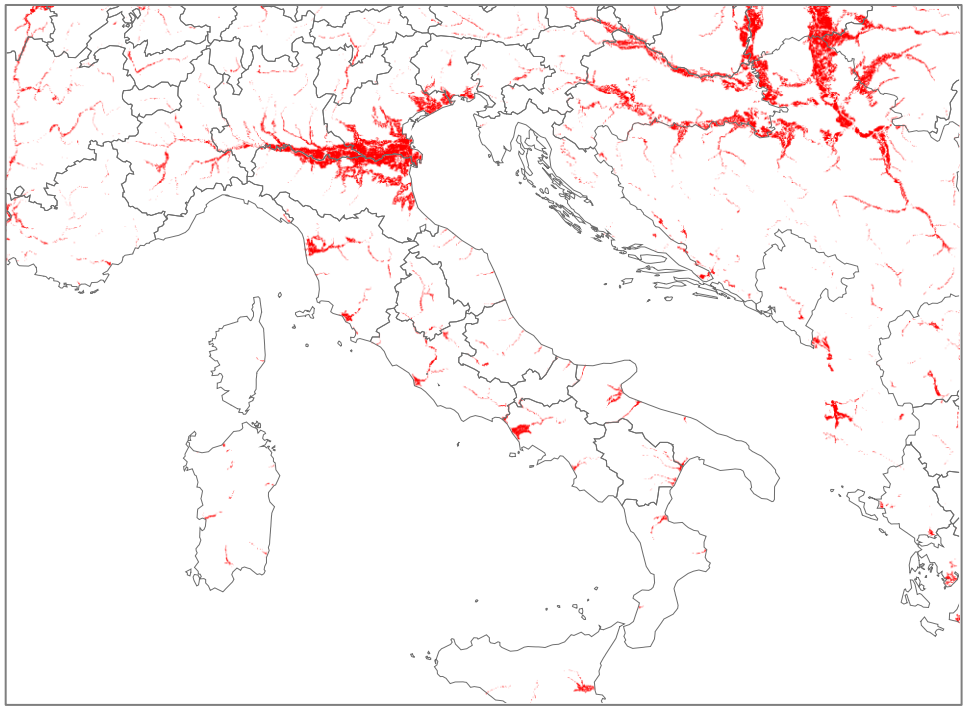
Thresholds potential runoff retention

- Natural & semi-natural = 61
- Agricultural areas = 52
- Artificial areas = 27

- Based on potential values for each class
- Suitable for comparisons over time (kept fixed)

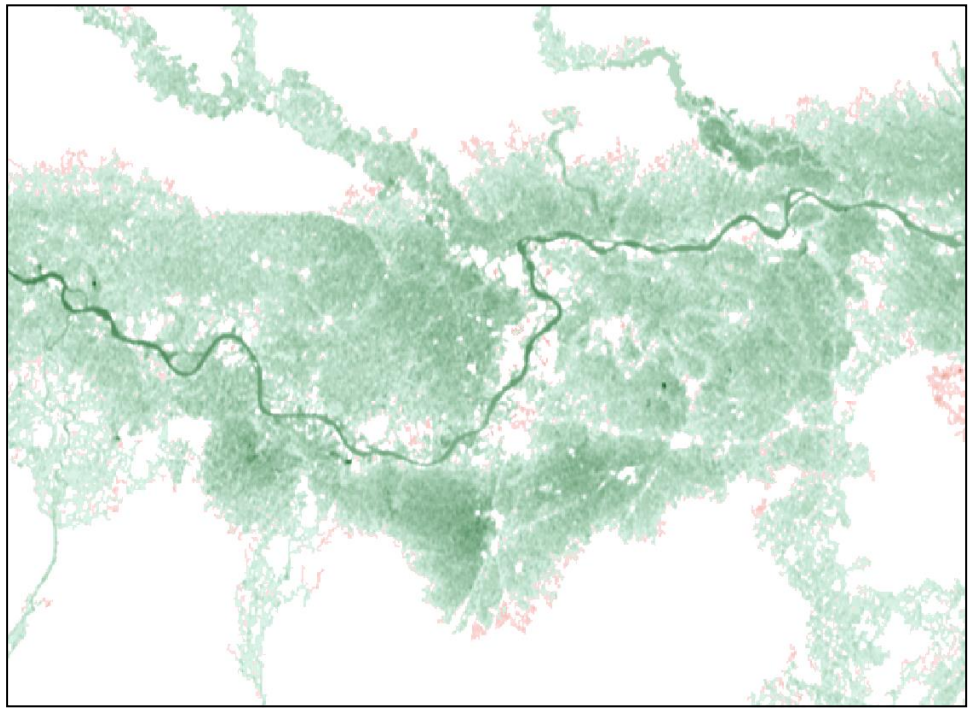
Flood control demand

Maps of floodplains at EU level



Settlements and other artificial areas

Floodplains: different return periods



500 years: higher water depth!

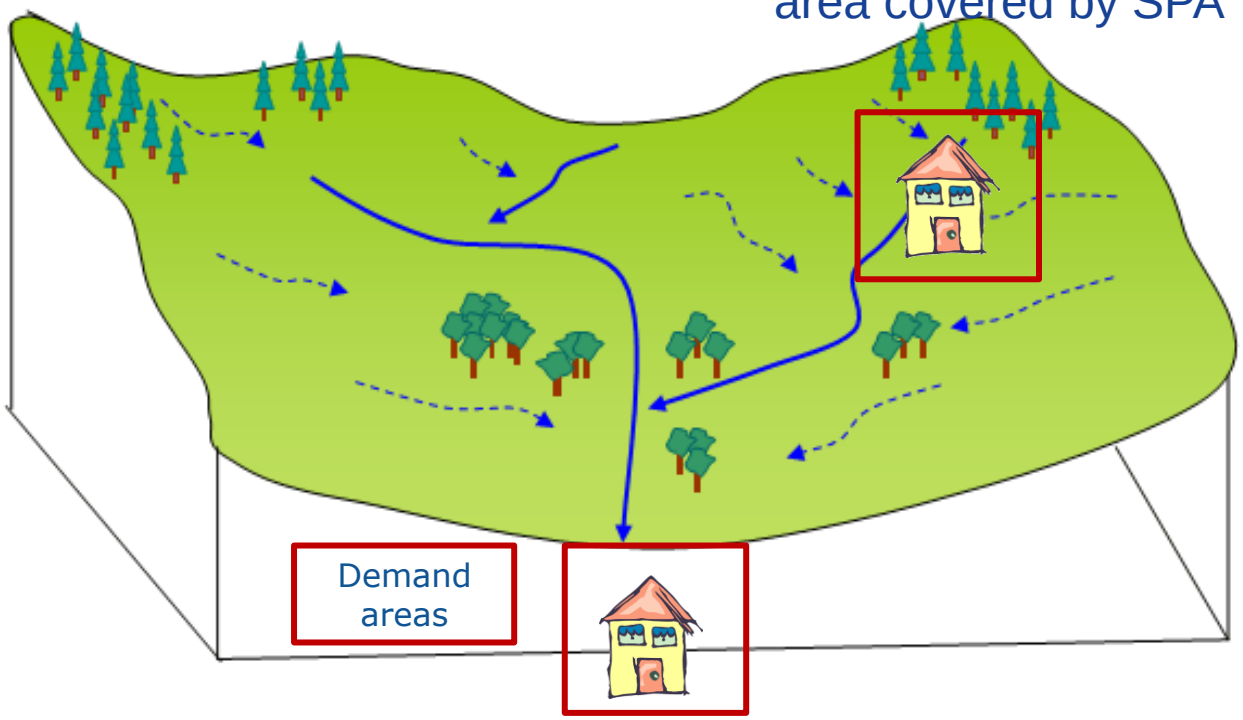
Service Demanding Areas (SDA)

Flood control use/flow

Service flow=ratio 1

100% of the upstream area covered by SPA

Ecosystem areas (SPA)



Catchment

∑ ratio x pixel size

1.2 ha of service flow

Service flow=ratio 0.2

20% of the upstream area covered by SPA

Importance of hydrological boundaries: river basin

Supply & use tables for the EU

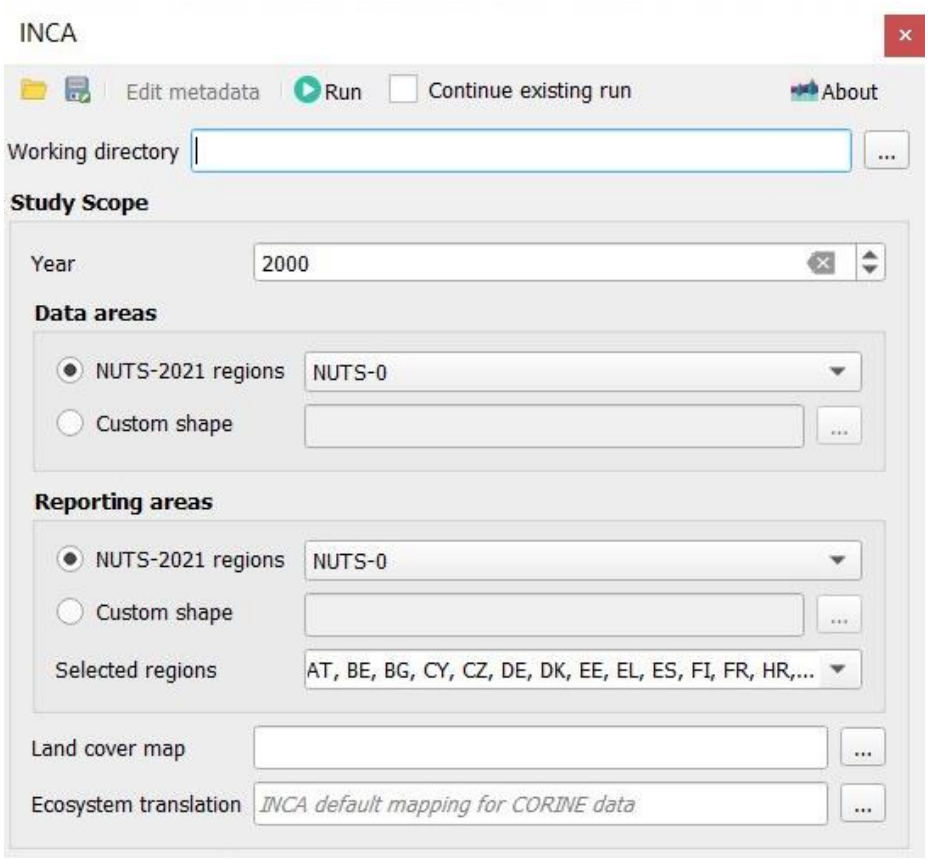
Supply

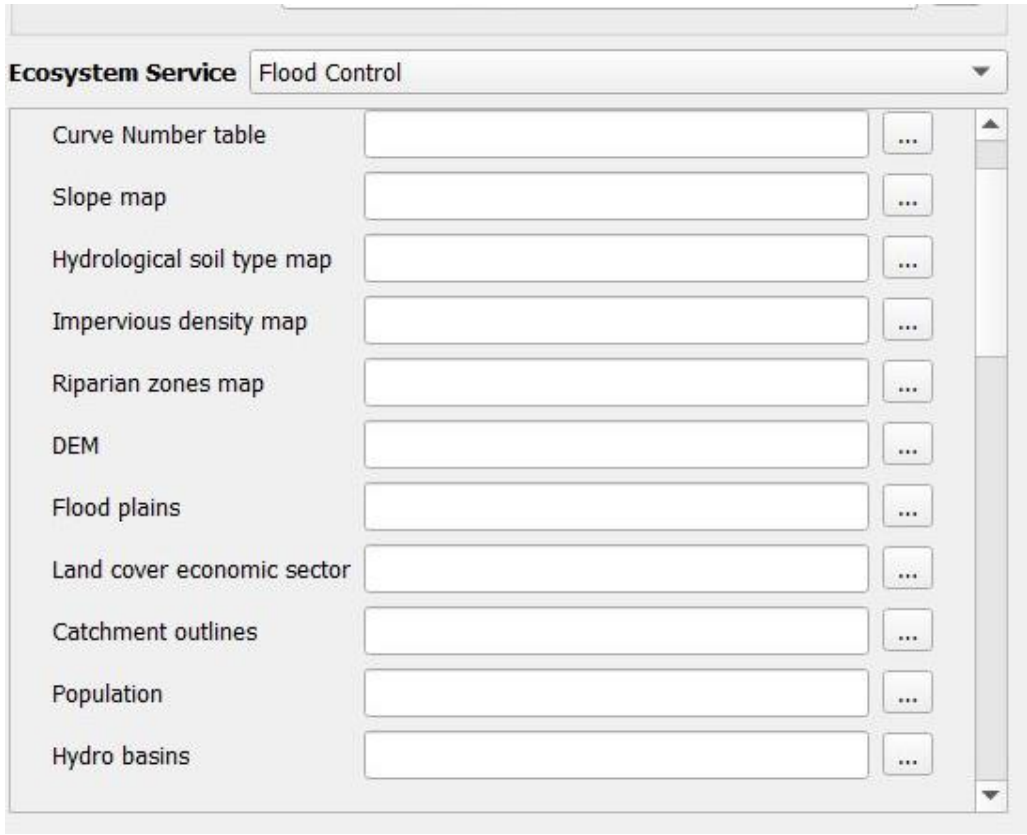
	Settlements and other artificial areas	Cropland	Grassland (pastures, semi-natural and natural grassland)	Forest and woodland	Heathland and shrub	Sparsely vegetated ecosystems	Inland wetlands	Rivers and canals	Lakes and reservoirs	Marine inlets and transitional waters	Coastal beaches, dunes and wetlands	Marine ecosystems (offshore coastal shelf and open ocean)	Total
km²													
EU 2000	329	3,197	6,178	28,769	622		493						39,587
EU 2006	328	3,186	6,164	28,714	618		492						39,502
EU 2012	341	3,273	6,346	28,946	628		493						40,026
EU 2018	328	3,164	6,142	28,563	616		491						39,304

Use

	Intermediate consumption by industries	Government final consumption	Households final consumption	Gross capital formation	Exports	Total
km²						
EU 2000	36,135	2,476	976			39,587
EU 2006	36,028	2,489	985			39,502
EU 2012	36,445	2,540	1,042			40,026
EU 2018	35,784	2,520	999			39,304

QGIS plugin for flood control – INCA Tool





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

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Challenges & future developments

- Upscale further model components including the adjustment for tree cover density: demand, use
  - Backwards comparability to previous accounting years?
- Not all data are available for the same accounting year and closer releases are used as proxy (e.g., extent, imperviousness)
- Inclusion of flood control with tree cover density for urban analyses

Thank you, questions?

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