

Introduction to ARIES

Brian Voigt, Ken Bagstad, Zuzana Harmackova

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Klima Aldaketa Ikergai



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Presentation outline

- Motivation and basic concepts
- ARIES overview
- Link to current ES-related challenges and developments



Why are we here?

Motivation and basic concepts

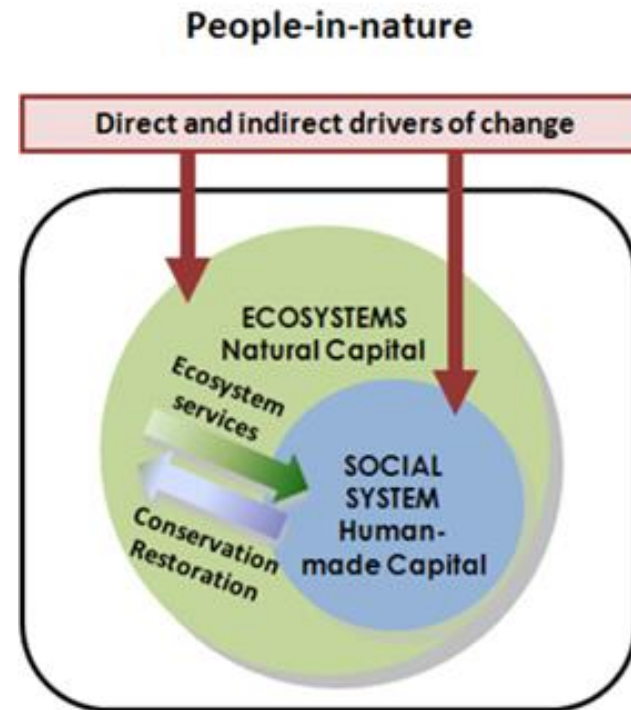
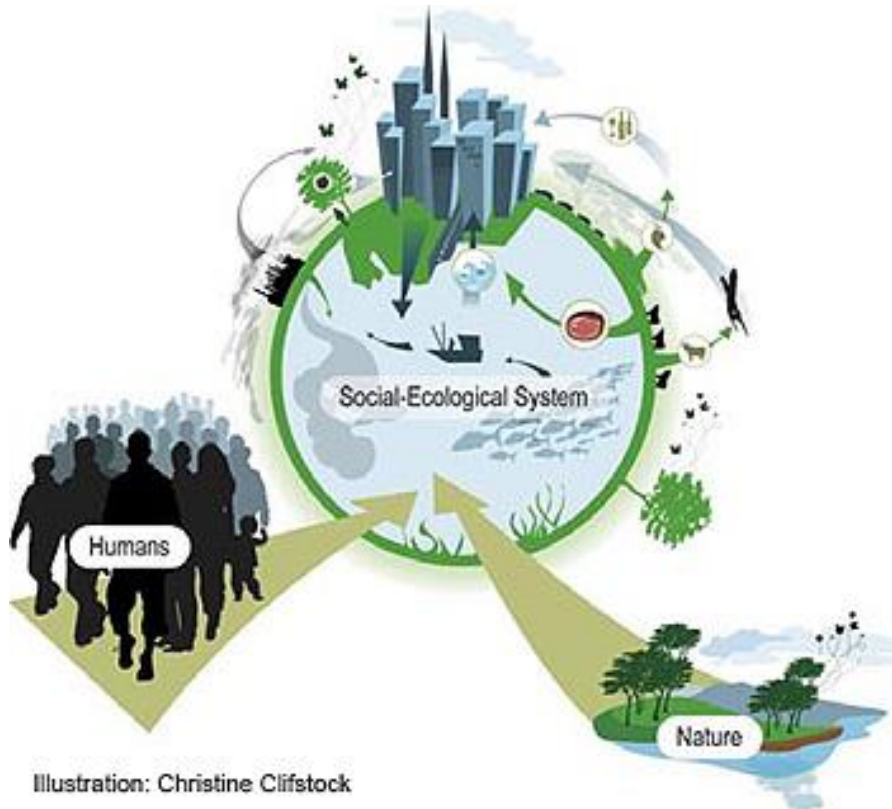


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Social-ecological systems



- Complex, interlinked systems of nature and society
- **Human well-being & economic prosperity** highly dependent on **natural capital**



Ecosystem services

Crop provision



Timber provision



Water quality regulation



Climate regulation



Recreation potential



Spiritual enrichment

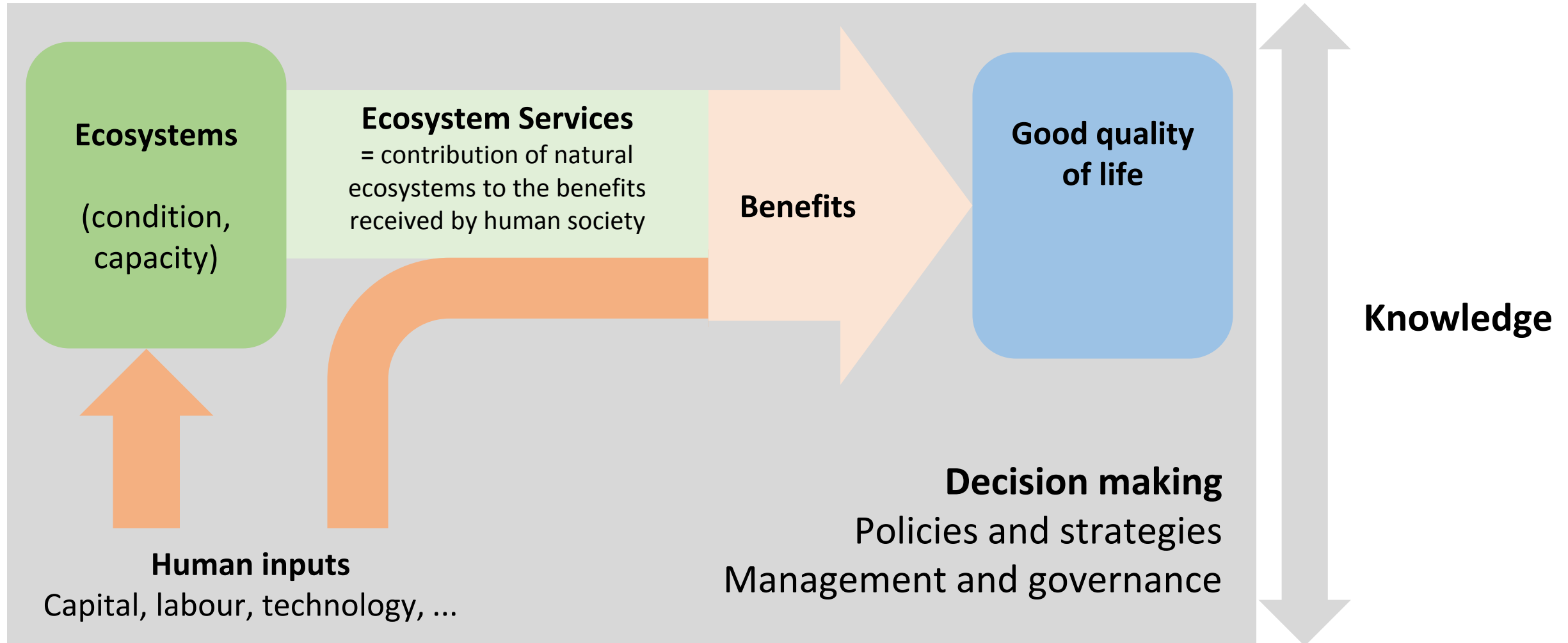


Types of ES

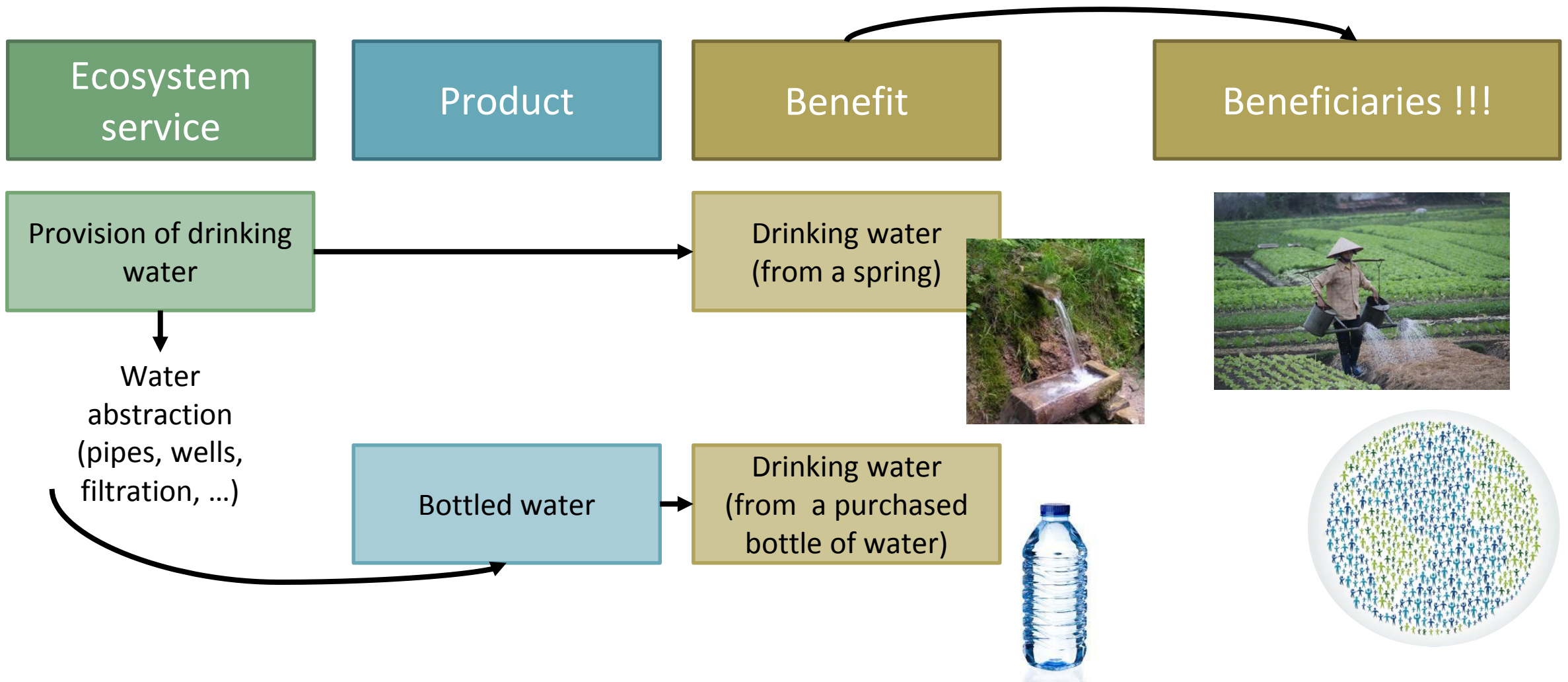
- Provisioning: material contributions from ecosystems
- Regulating: providing benign living conditions
- “Cultural”: non-material contributions from ecosystems



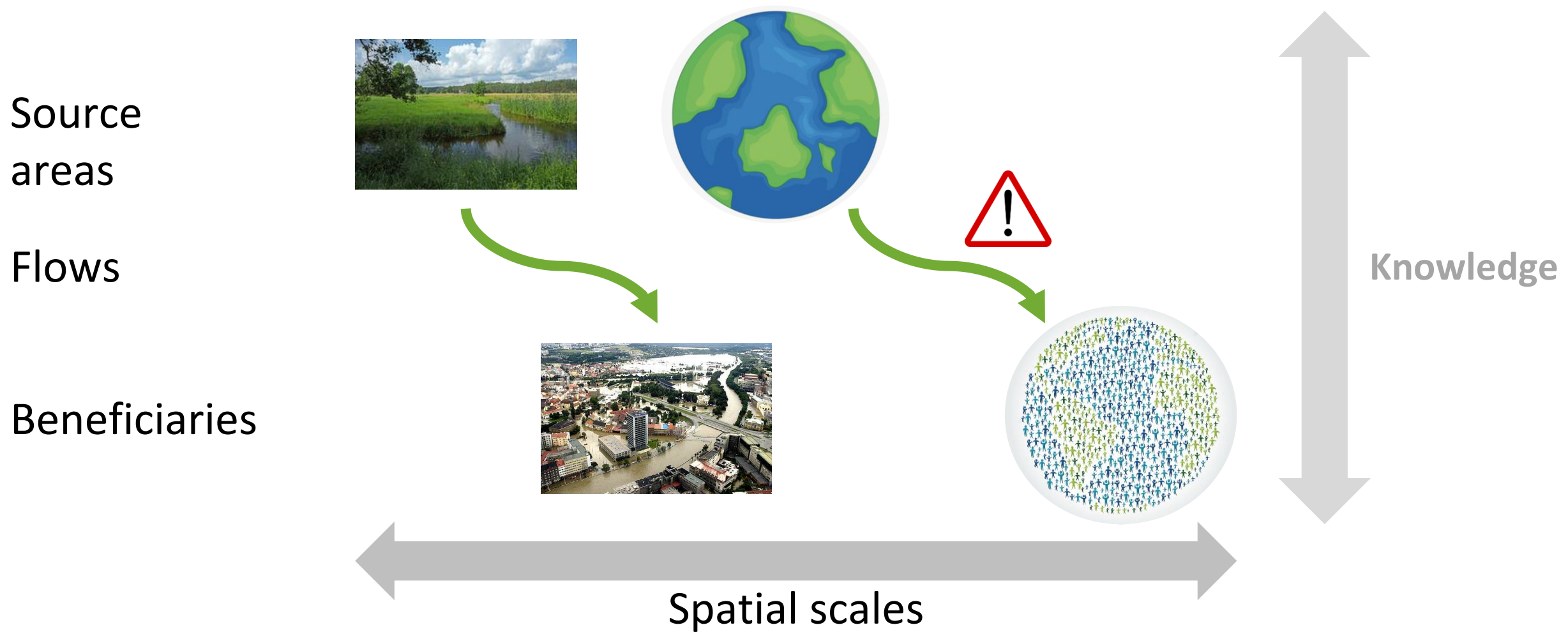
From ecosystems to good quality of life



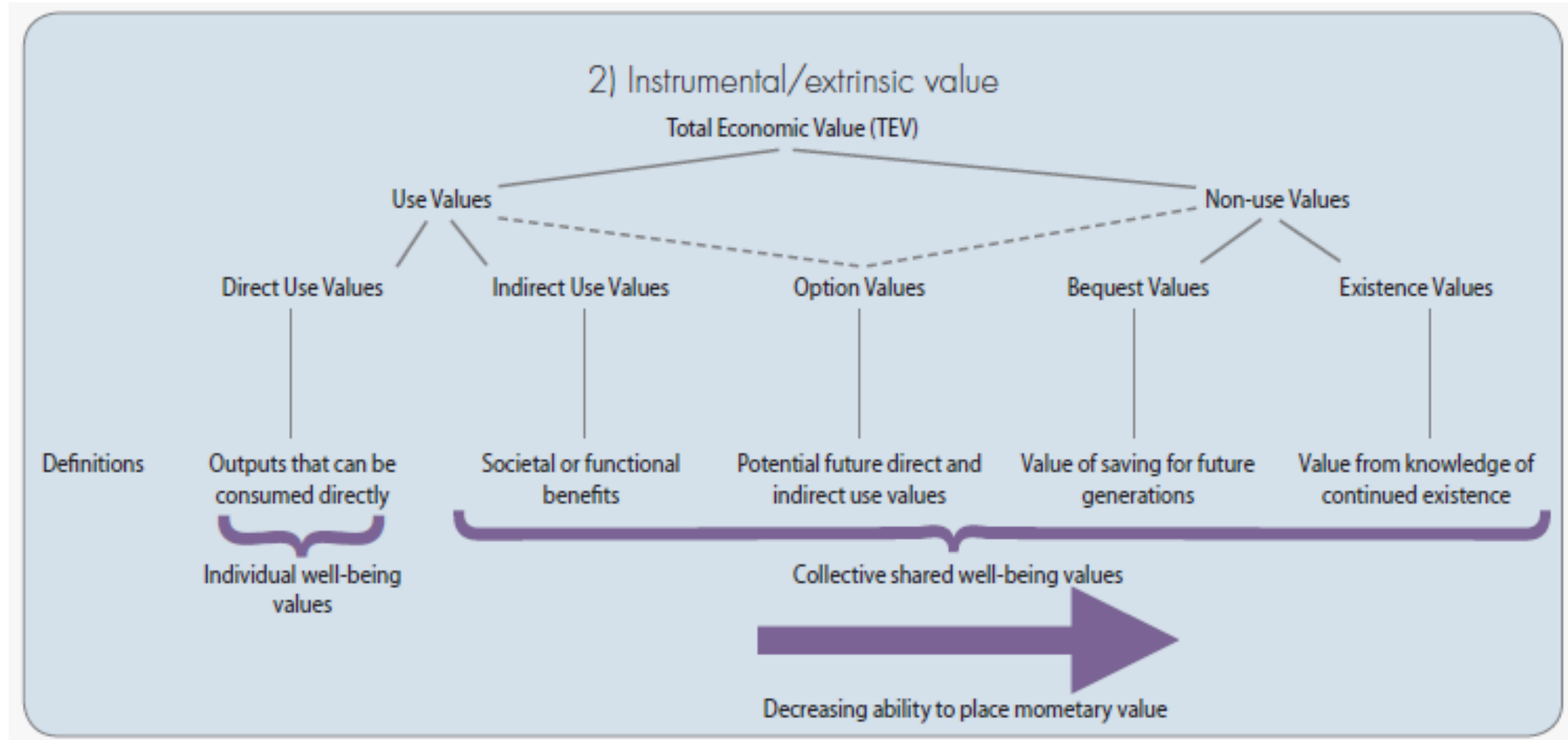
Chain from ES to beneficiaries



Spatial aspect of ES flows



Types of values



Practice-relevant aspects of the ES concept

- Sustainable provision of ES?
- Governance of ES provision?
- ES co-production by nature and people
- (Spatial) mismatches between ES provision and beneficiaries?
- Telecoupling



ARIES basics and overview



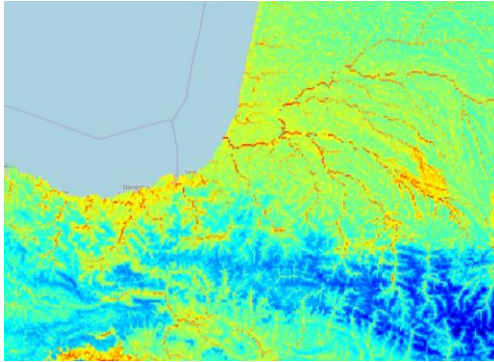
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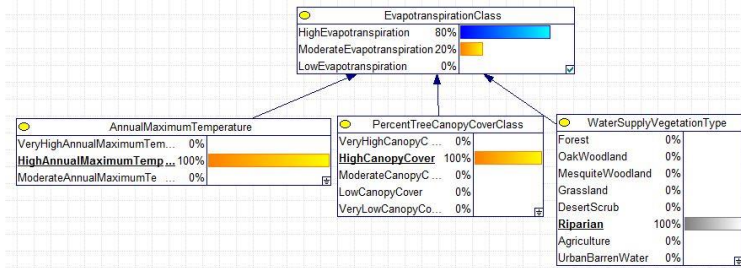
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ARIES modelling environment

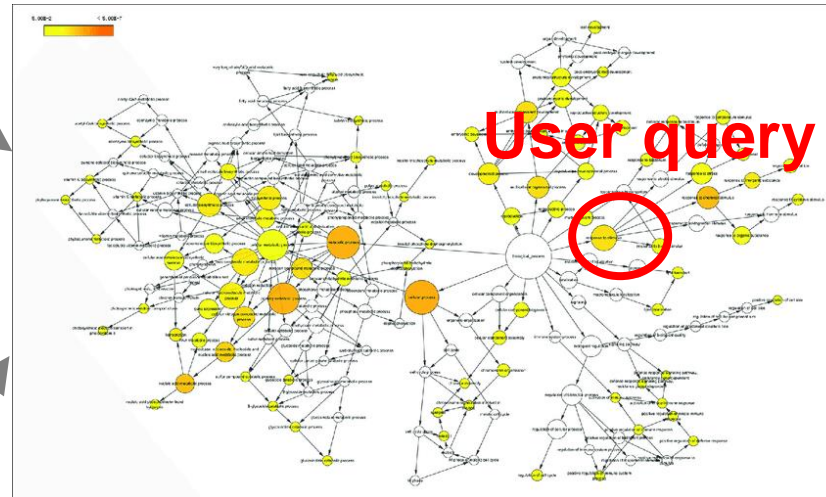
Semantically
annotated data



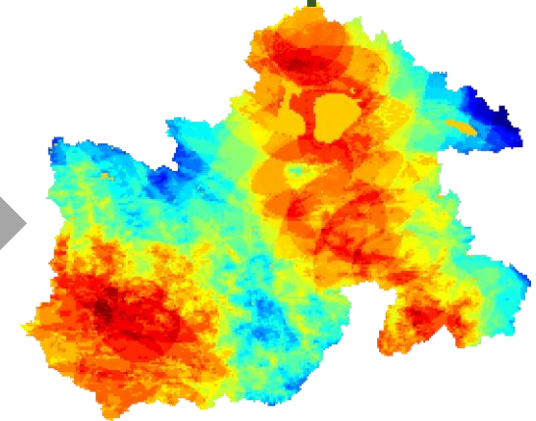
Semantically
annotated models



System of ontologies



Resulting ES
(provision)
map



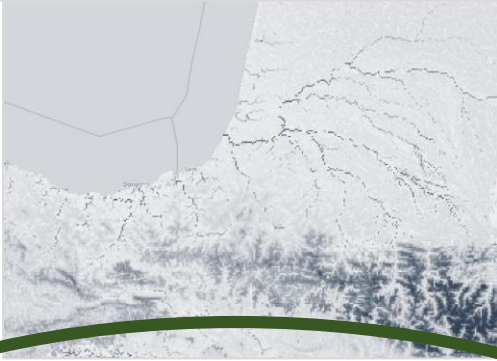
User-provided
context



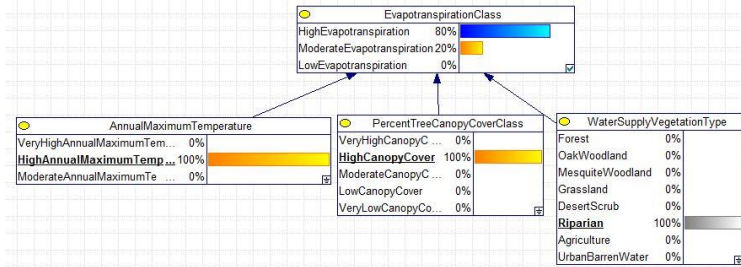
Σ Data and models "labelled"
based on their **meaning**

ARIES modelling environment

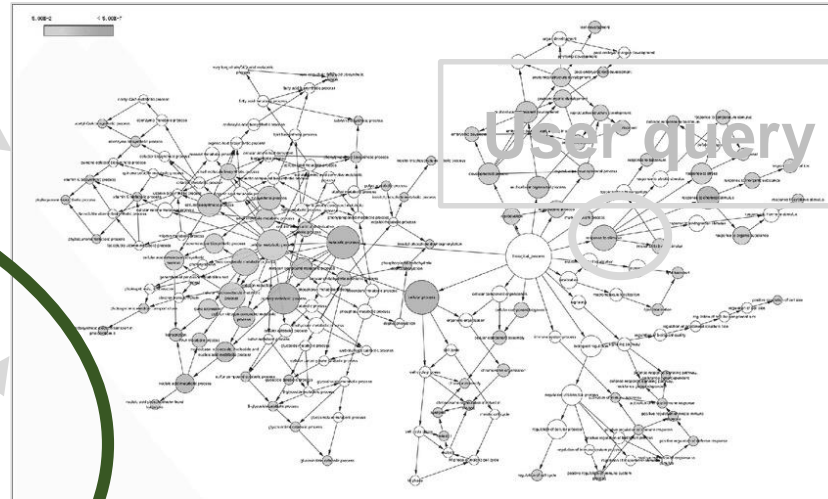
Semantically
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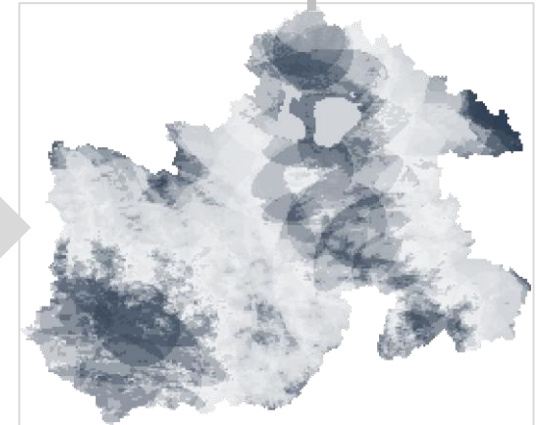
Semantically
annotated models



System of ontologies



Resulting ES
(provision)
map



Global models, complex models, ...



User-provided
context

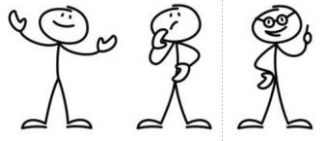
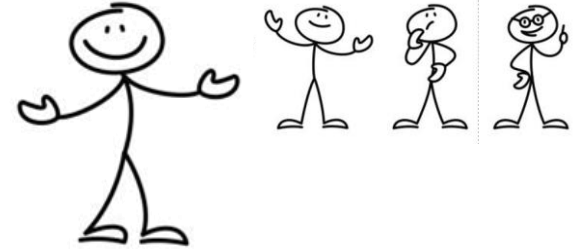
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```

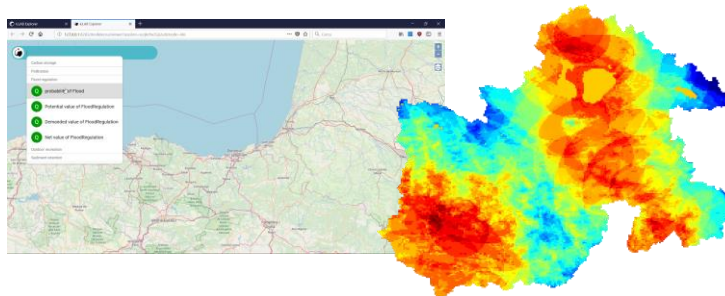
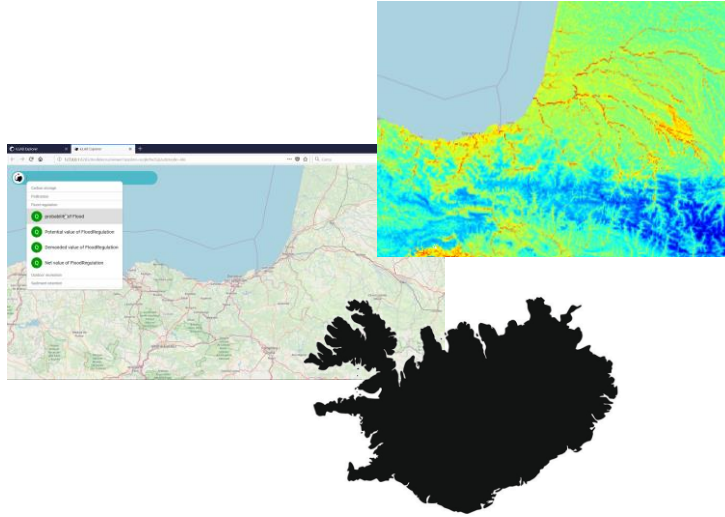
@documented(recreation.values.potential)
model in: Potential value of behavior:Outdoor behavior:Recreation
observing
  magnitude of proportion of behavior:Outdoor in behavior:Recreation named human_influence,
  distance to conservation:ProtectedArea in m named distance_to_pristine_areas,
  distance to earth:Coastline in m named distance_to_coast,
  distance to earth:Waterway in m named distance_to_streams,
  distance to earth:WaterBody in m named distance_to_lakes,
  distance to earth:MountainPeak in m named distance_to_mountains
set to [
  human_influence *
    ((nodata(distance_to_pristine_areas) ? 0 : distance_to_pristine_areas)
    + (nodata(distance_to_lakes) ? 0 : distance_to_lakes)
    + (nodata(distance_to_streams) ? 0 : distance_to_streams)
    + (nodata(distance_to_mountains) ? 0 : distance_to_mountains)
    + (nodata(distance_to_coast) ? 0 : distance_to_coast))
] then [ self.invert() ];

```

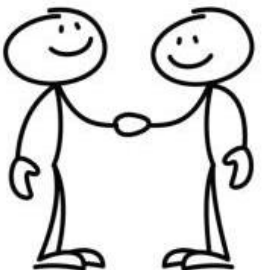
Modeller interested in semantics: k.LAB Modeller



ES researcher/practitioner
interested in parametrizing
their models: k.EXPLORER
with local data and contexts



Quick ES assessment:
k.EXPLORER



A decade of ARIES development

2007
**US National
Science
Foundation**

2012
BC3

2013
1st ISU

2017
**Integrated
Modelling
Partnership**

2018
k.EXPLORER





ARIES: Artificial Intelligence for Ecosystem Services

- <http://aries.integratedmodelling.org>
- **Integration of multiple modelling techniques** from multiple scientific fields
- Support of **artificial intelligence** (semantics, machine reasoning, machine learning)
- Connecting **data and models from multiple sources**
- **Modelling and mapping of** natural capital, natural processes, human beneficiaries, service flows to society
- Providing knowledge-base to **value and manage the ecosystems**





Integrated Modelling Partnership

- <http://www.integratedmodelling.org>
- Modelling paradigm suitable to **address complex social-ecological problems**
- Development and maintenance of:
 - A shared modelling environment to **connect existing data and models**
 - The k.IM semantic **modeling language** to define such an environment
 - The k.LAB **software** stack as an **interface**
 - Integrated development environment (IDE) geared to modelers
 - A set of web-based, end-user interfaces that for non-technical actors and decision-makers



k. LAB software: “Knowledge Laboratory”

- Connecting data and models from multiple **shared network** repositories
 - Data and models from multiple users and disciplines
- **Selection of the most suitable data and models** guided by machine learning
- Aim: To serve a growing number of worldwide **users** from academia, governments, NGOs and industry



What is the added value of ARIES?



- **Integrated** ES assessment **across scales**
- Targeted at the needs of global, regional and local **decision makers**
- **Holistic** conceptualisation of ES flows
 - Addresses different ES-related discourses (ecosystem accounting, ES co-production by ecosystems and human society, assessment of the sustainability of ES provision, ES trade-off analysis and scenario planning)
- **Freely available** online platform, based on open data- and model-sharing principles

... more in the following slides, presentations & course days



Addressing current ES-related challenges and developments



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Current global processes requiring knowledge on ES

- Natural Capital Accounting initiatives
 - UNSD System of Environmental-Economic Accounting (SEEA)
 - World Bank Wealth Accounting and the Valuation of Ecosystem Services (WAVES)
- Science-policy interface
 - Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)
 - EU Mapping and assessment of ecosystems and their services (MAES)



Natural Capital Accounting

Economic performance of countries measured by **GDP...**

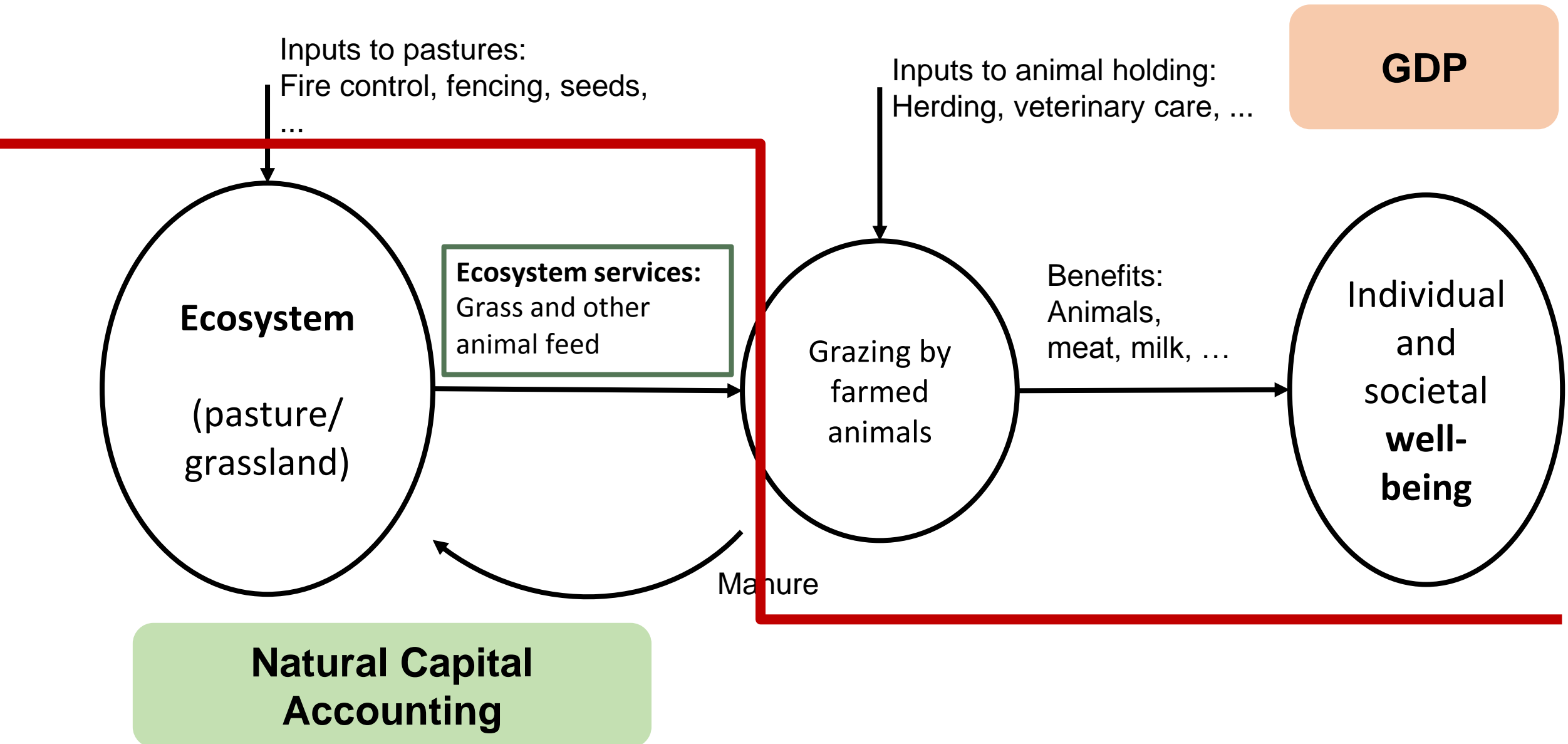
...but GDP **does not capture use of natural capital**, degradation and exploitation

Potential impacts on sustainable use of resources, economies and good quality of life

Natural Capital Accounting

Support for better economic management and inclusive development

Natural Capital Accounting



Natural Capital Accounting

Natural capital



Stocks of natural resources

(land, water, fisheries, minerals, ...)

Ecosystems

Flows of natural resources

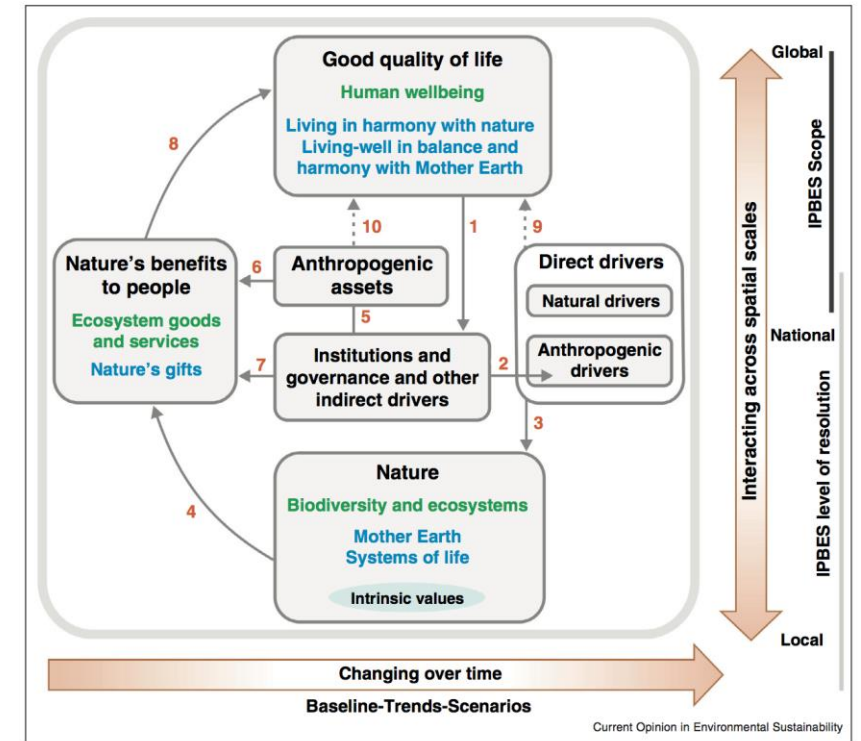
(timber, water, minerals, ...)

Flows of ecosystem services



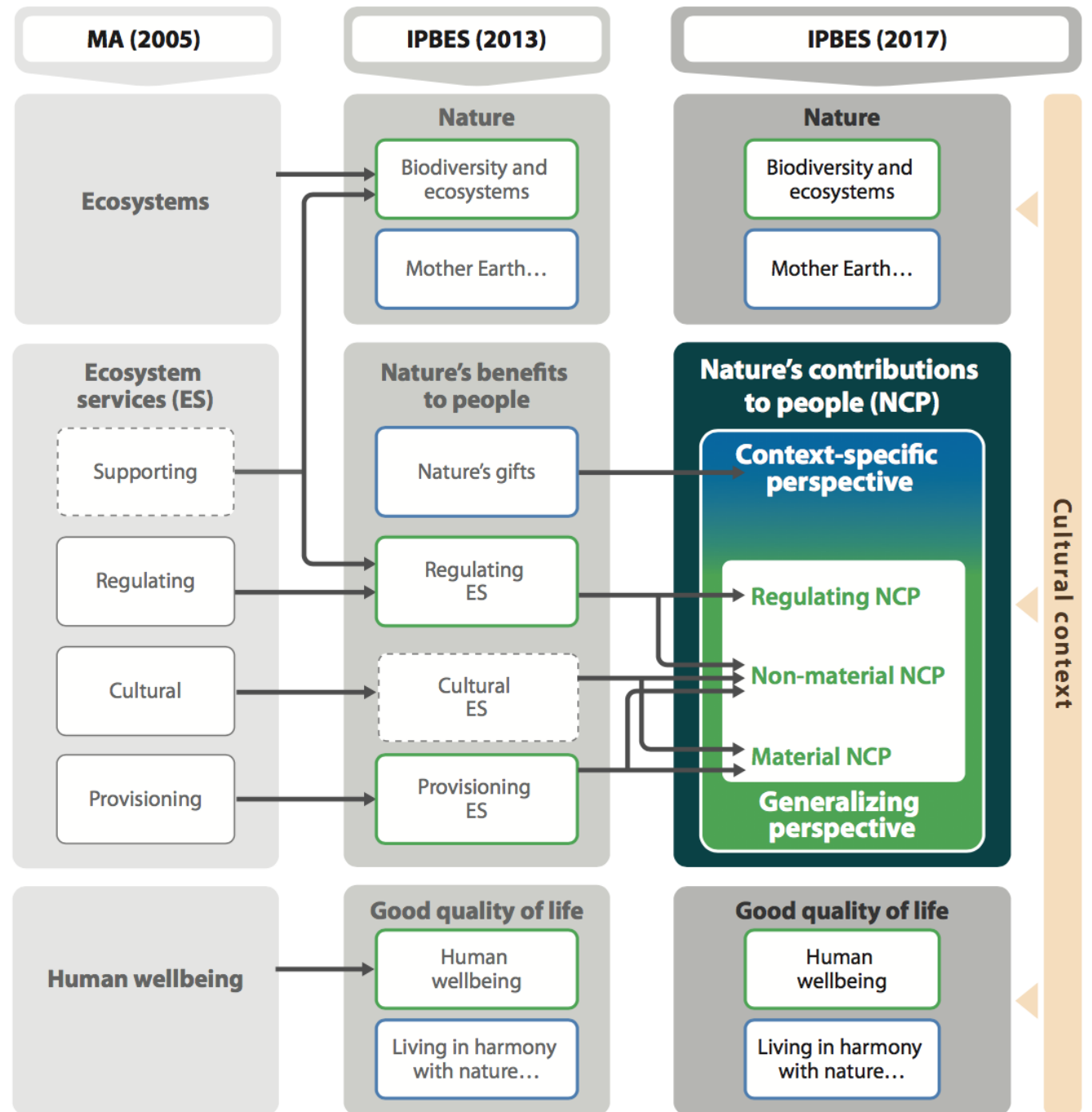
Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)

- A UN-related platform established 2012, over 130 member countries
- Aims:
 - Undertaking international **assessments**,
 - Catalyzing **knowledge generation**,
 - Promoting the development and use of **policy support tools**,
 - Undertaking and facilitating **capacity building**.

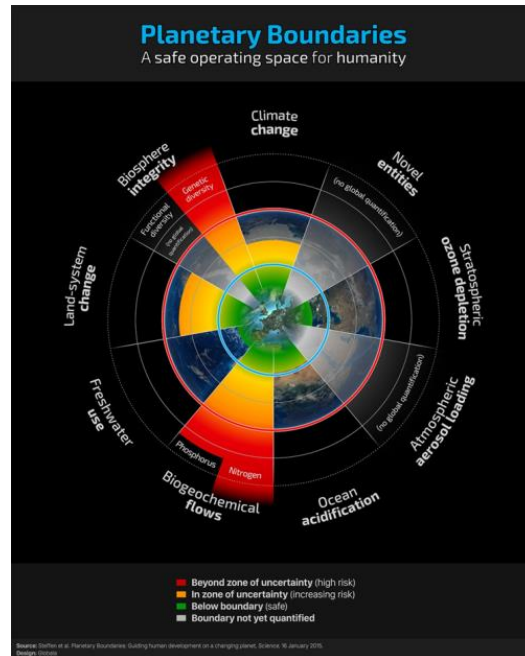
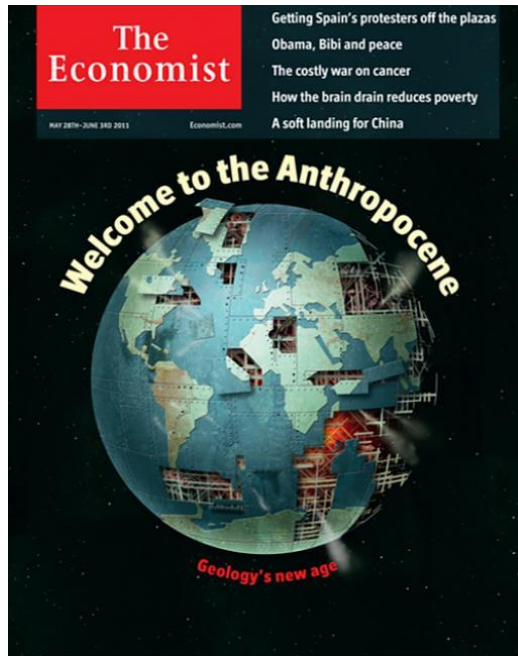


Ecosystem Services and/or/vs Nature's Contributions to People

Diaz et al. 2018 Science



Global change and sustainability

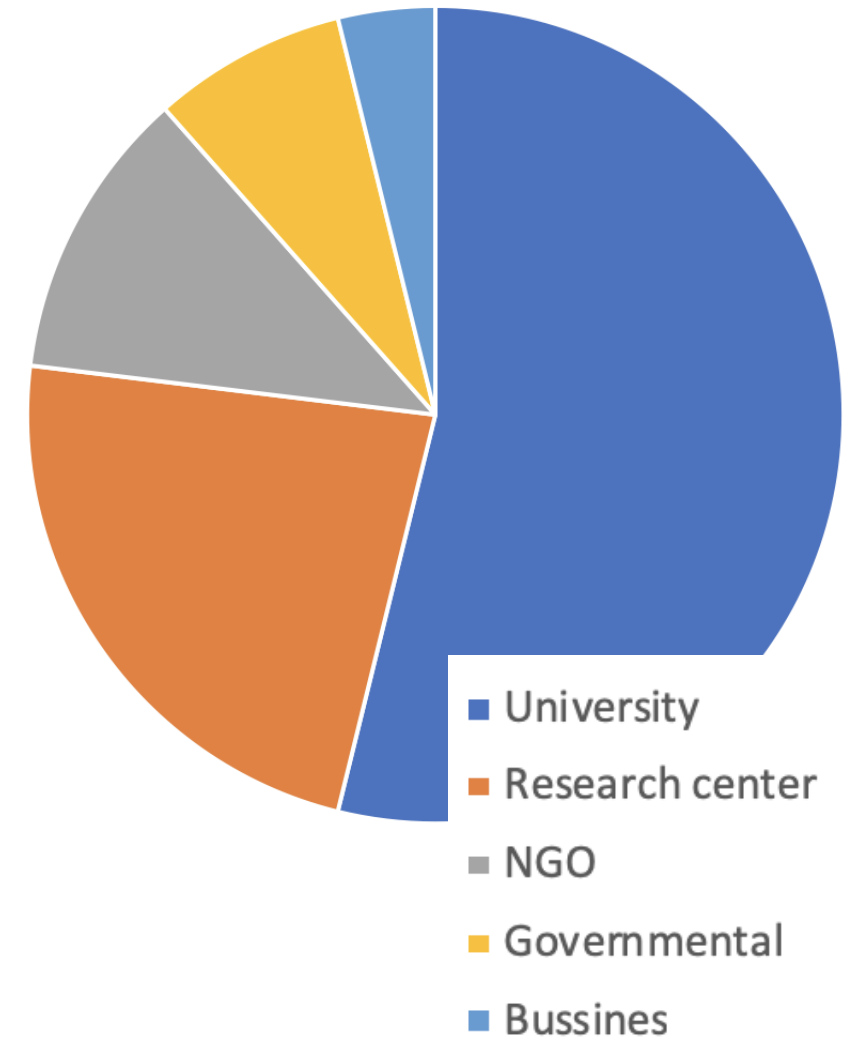


Knowledge



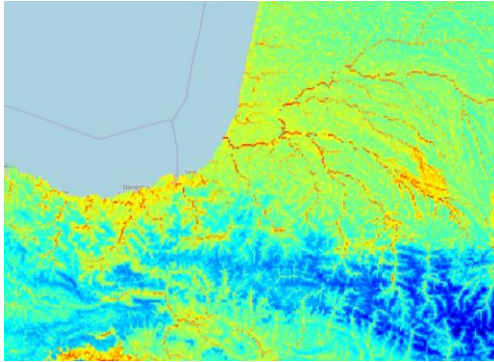
What will I learn at this course?

- What is ARIES?
- What is the ARIES environment and available models?
- What technical principles is it based on?
- What results and knowledge can it provide?
- How does ARIES address the current practice and decision-making?
- Examples of applications
- How can I use ARIES to solve my (research) questions?

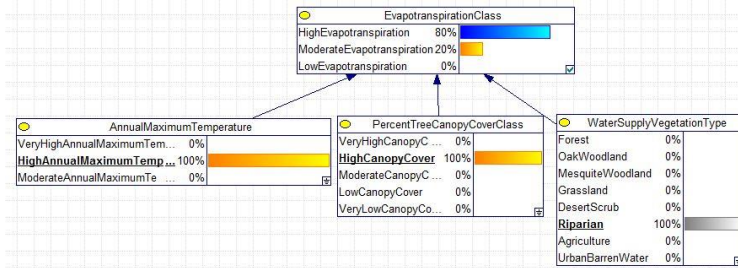


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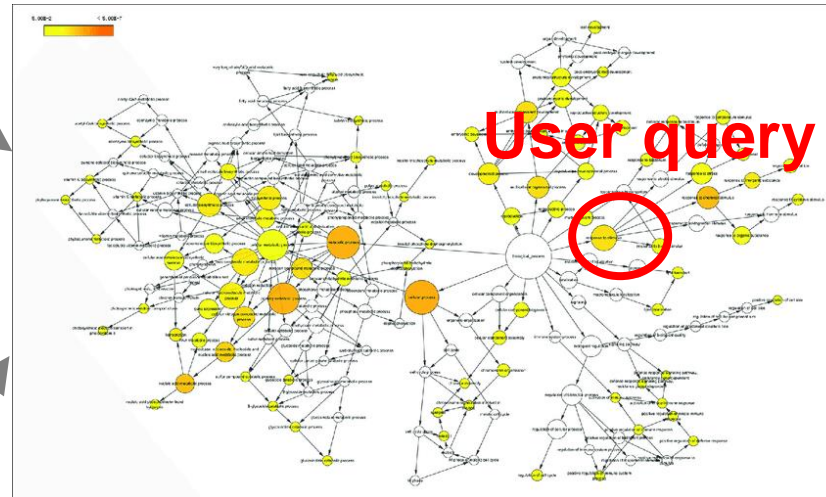
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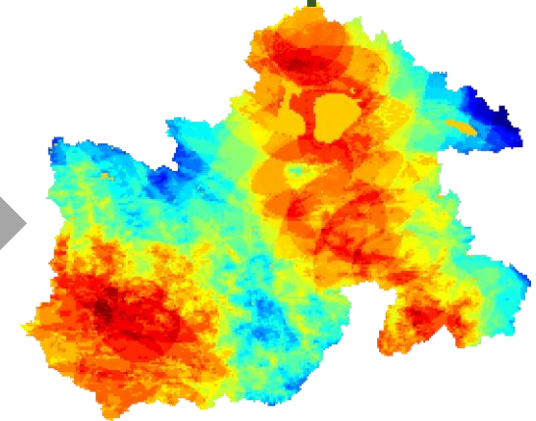
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