

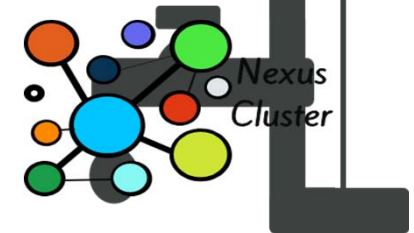
# Quantitative story-telling for a more robust understanding of the nexus

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# Take Home Messages

- How quantified evidence is selected and interpreted via story telling
- Foundation = MuSIASEM - Multi-scale Integrated Analysis of Societal and Ecosystem Metabolism
- Cross sector and cross scale accounting framework for multiple variables preserving the view of the whole system
- Applied to range of policies and innovations from EU28 to individual cities or social groups
- Insightful for complex coupled social-ecological systems but more demanding for interpretation



*"Cleverclogs here has all the answers but never the right ones!"*

# Post Normal Science

*The Post-Normal Times*

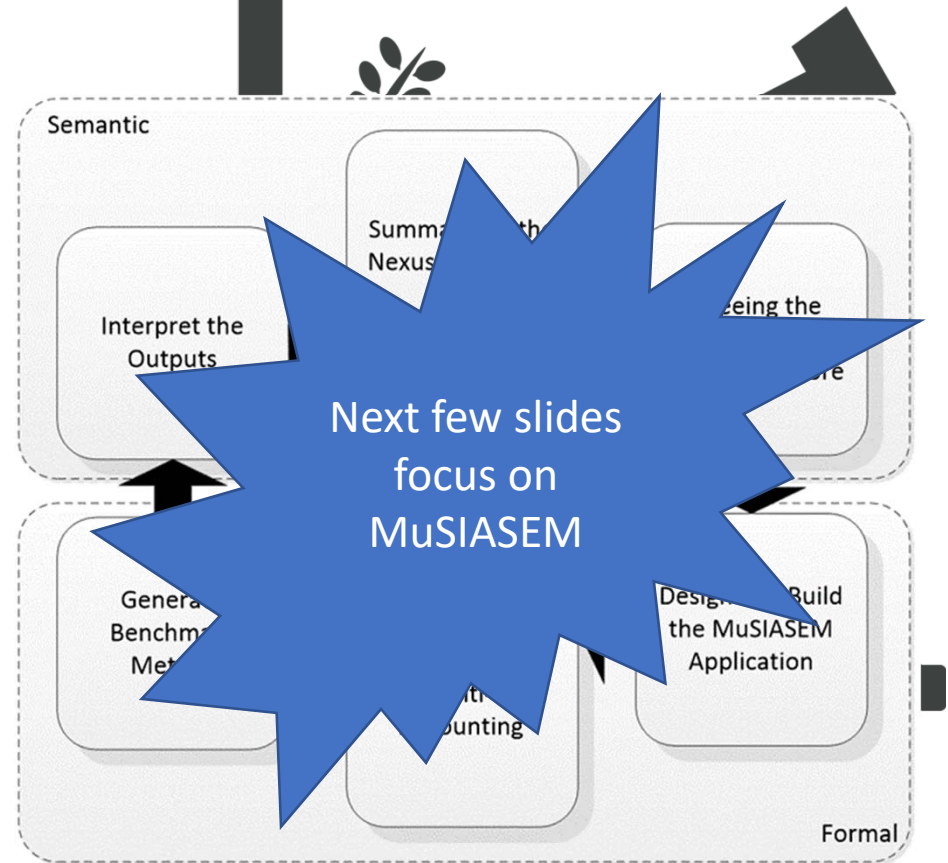
Putting Science into Context

- Critical questions about how science is produced and used when “facts [are] uncertain, values in dispute, stakes high and decisions urgent”
- Sustainability and the Nexus are wicked problems (long-term, contested, requires transformation not incremental changes)
- Attention to science – policy interactions
  - How problem is framed, what evidence is used, and the politics of process
  - Multiple legitimate perspectives (even if contradictory)
  - Extended peer community – all ‘experts’ with different expertise
- Quantification serves, not drives, deliberation



# Quantitative Story Telling – making metrics matter

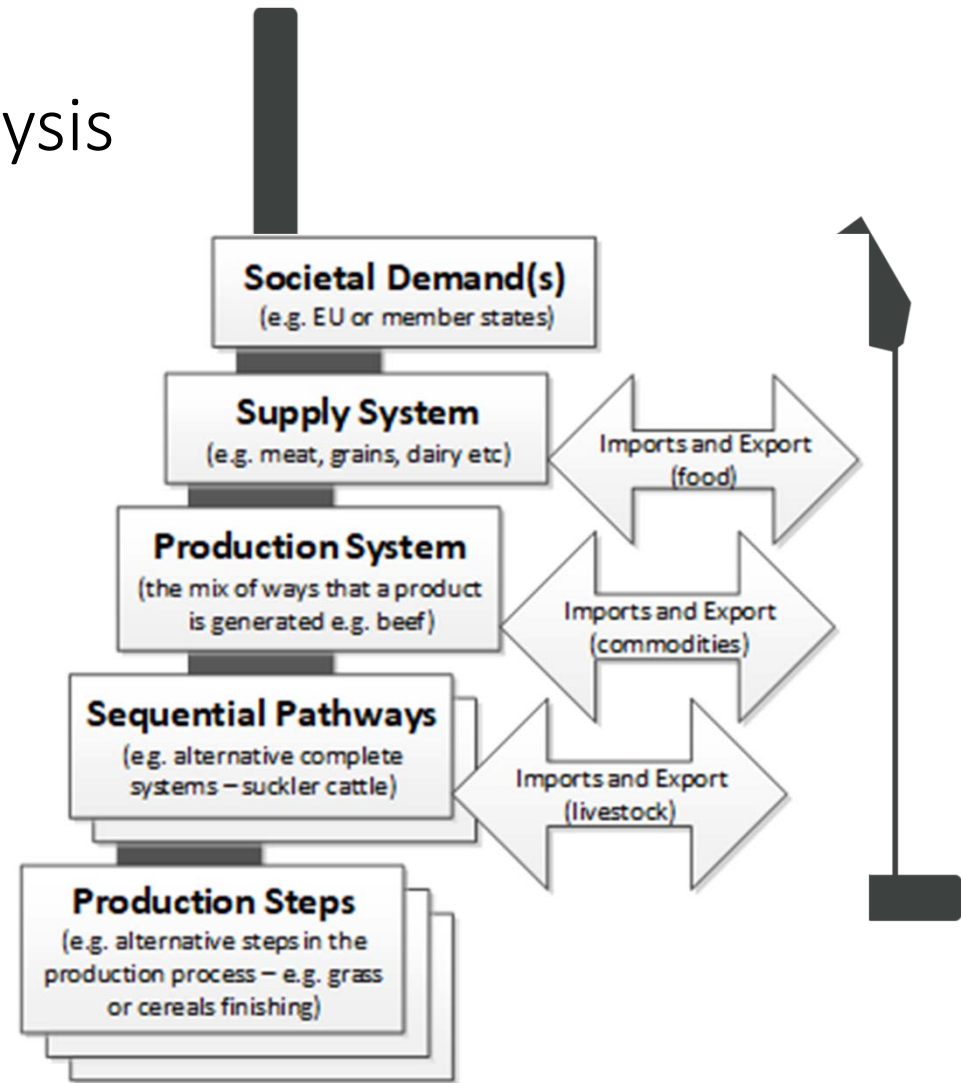
- Deliberative cycle for complex, contested, value dominated policy decisions
- Narratives shape analysis
- Dependencies of formal and semantic (imprediction)
- Attention to environment, economy and societal trade-offs
- Benchmarking – feasibility, viability and desirability



For more information, see <https://youtu.be/b5LBIFAUtBM>

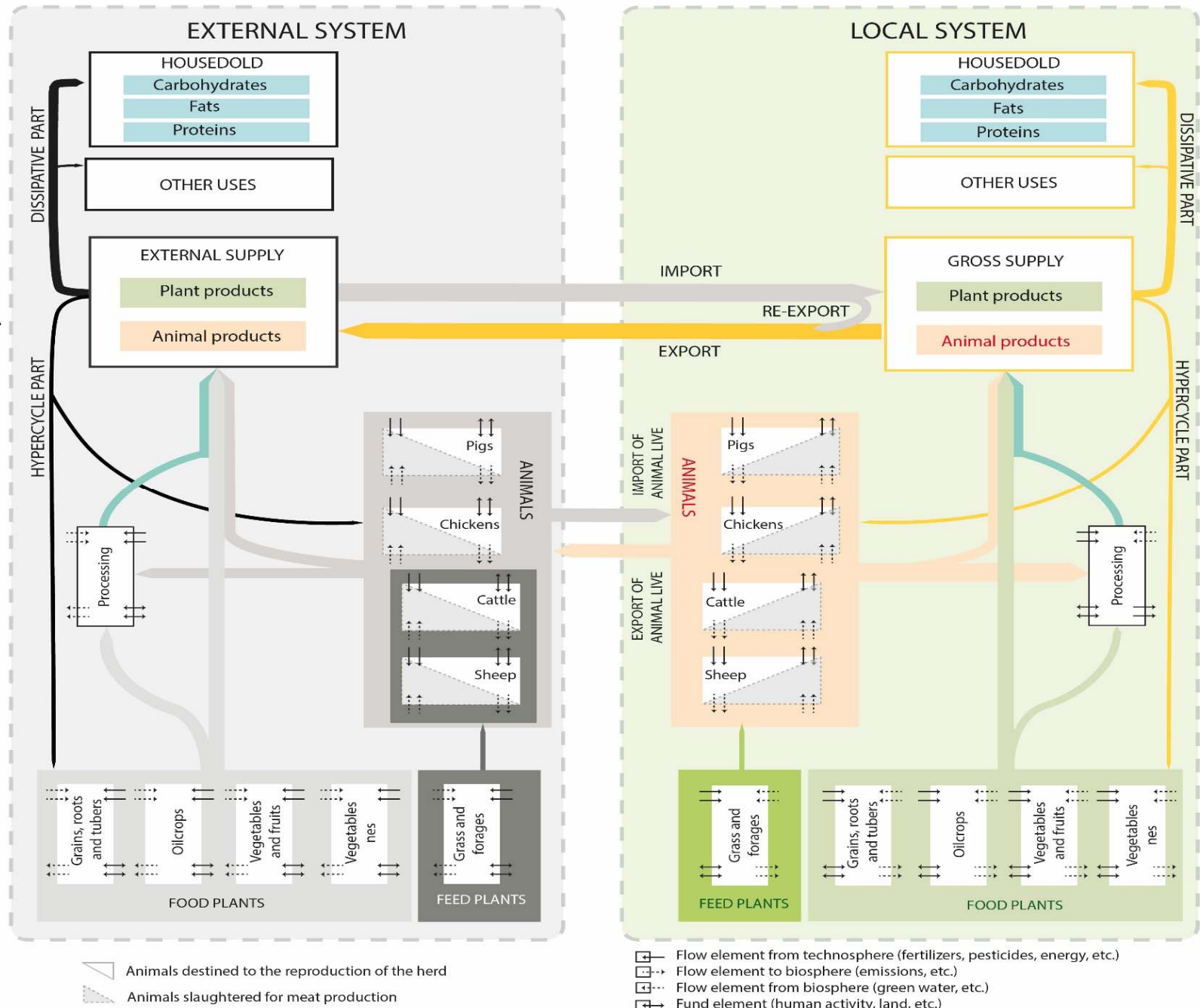
# Societal Metabolism Analysis

- Understand human-environment systems across space and time
- Focus on metabolic patterns – how are resources used to reproduce the system
- Magnitudes and Mixes of biosphere and technosphere
- Degree to which these are met locally (externalisation)
- Attention to multiple perspectives (geographical scale, hierarchy composition etc)



# GRAMMAR

A set of expected relations over chosen categories of accounting



# Building Blocks: Funds and Flows

## Definitions

### 1. “Funds”

- Remain within the system (define its identity, need to be maintained, overhead (e.g. physiological)
- Stay the same (within the defined time frame)
- Land, people, power capacity

### 2. “Flows”

- Enter or leave the system
- Materials, energy carriers, wealth

### 3. Flow-Fund ratios → metrics

#### Why metrics matter

##### Energy Intensity – TET/GDP (MJ/\$)

Finland – 12.6 MJ/\$

El Salvador – 12.6 MJ/\$

##### Flow/Flow

##### External referent – *human activity*

THA (hours) – extent – Flow/Fund

##### TET/THA

Finland – 29.73 MJ/hr

El Salvador – 2.92 MJ/hr

##### GDP/THA

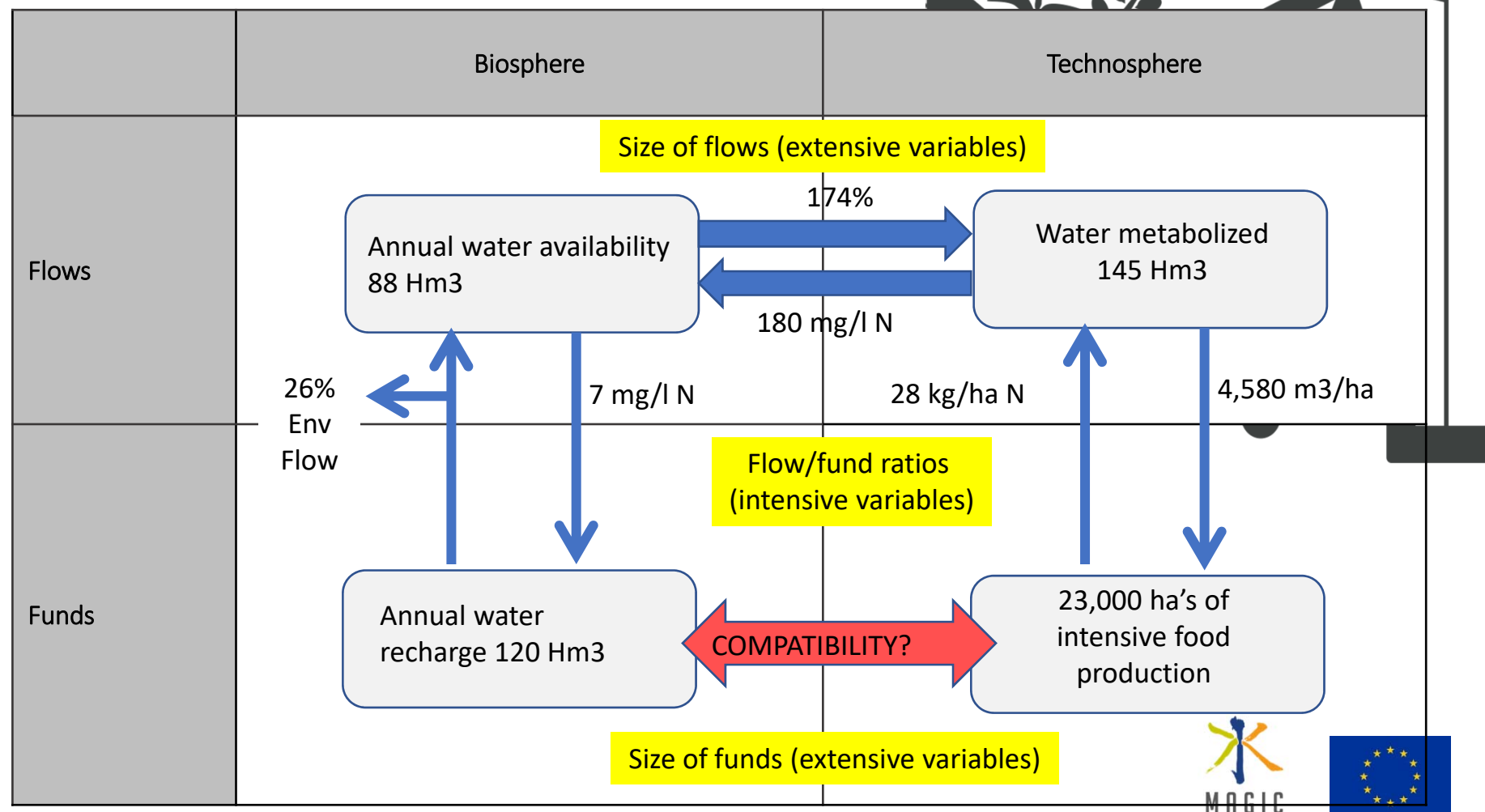
Finland – 20,600 \$/yr p.c.

El Salvador – 2,020 \$/yr p.c.



# Building Blocks: Metrics

Derived from a set of relations that define a coupled SES



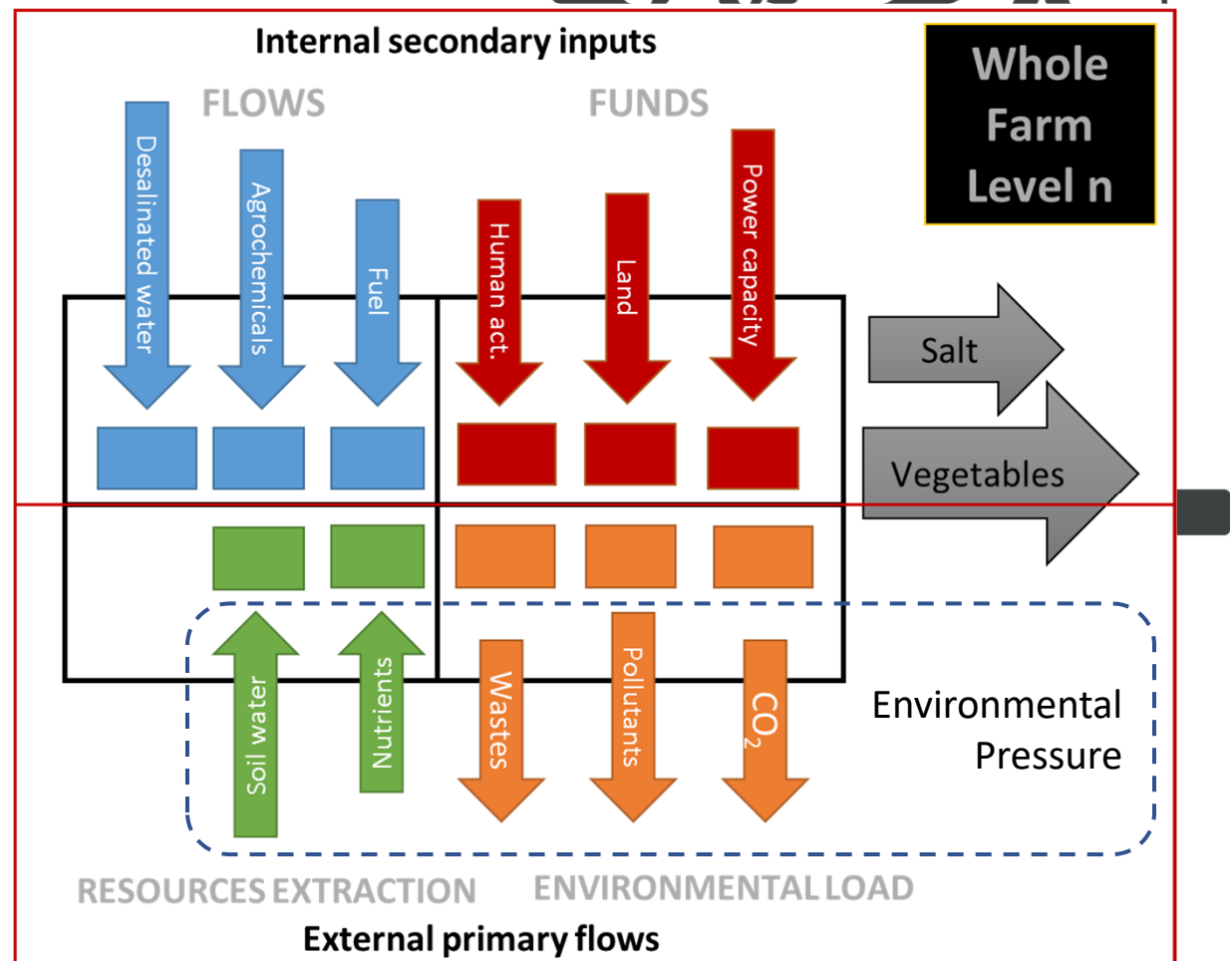
Example from El Egido (Almeria, Spain)



# Building blocks: Processor

- In MuSIASEM flows and funds are organised as Processors

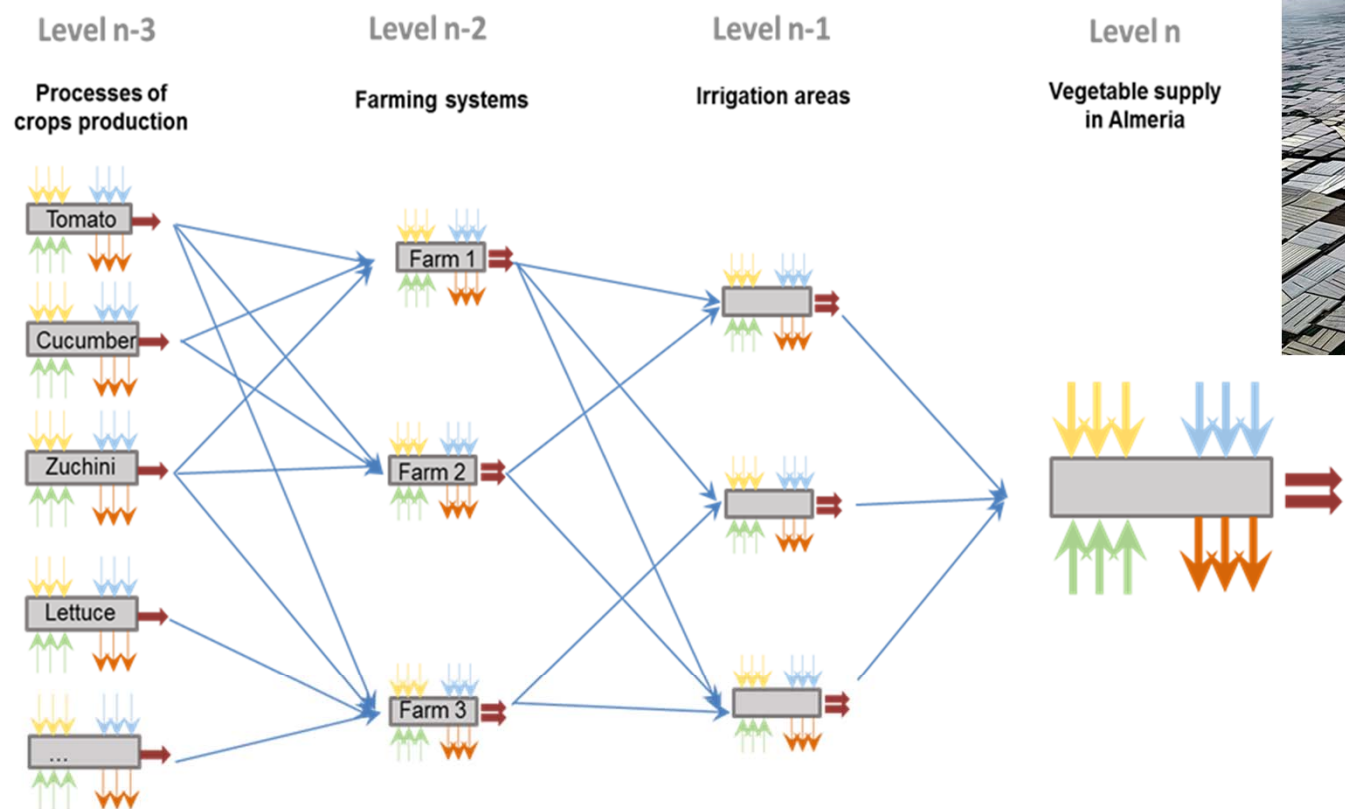
- Excel databases
- Core and satellites
- Scalable
  - Aggregate
  - Disaggregate
  - Inputs to macro-processes
  - Societal consumption patterns
- Linkable



# Simultaneous analysis over scales

Non-equivalent perspectives

Checking coherence and illustrating gaps in knowledge



Bottom-up: Determined by lower level characteristics (per unit of land or output)



Top-down: Determined by the compatibility between bottom-up scaling of farming typologies and boundary conditions provided by the socio-economic (viability) and the environmental contexts (feasibility)

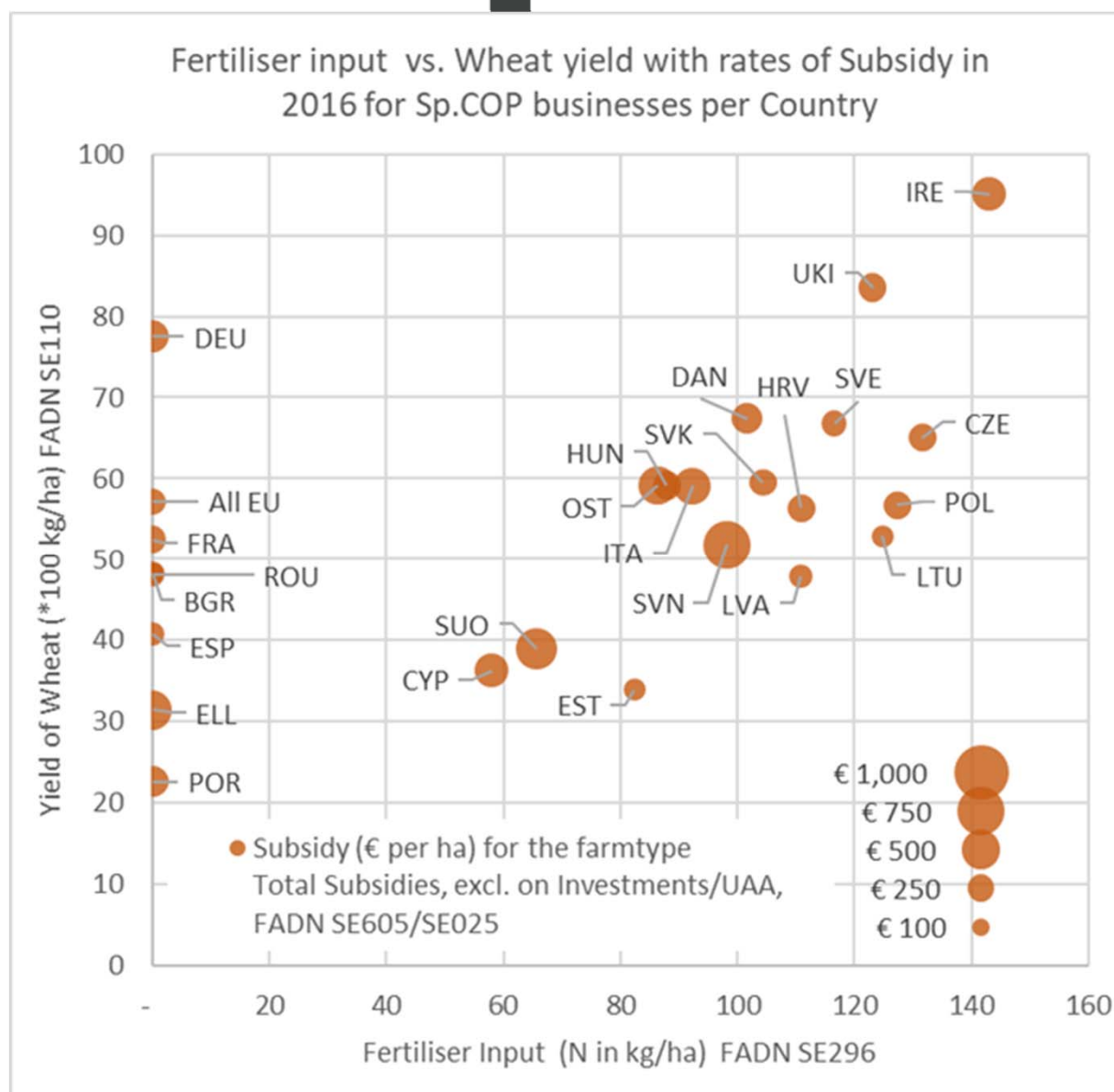


# QST in action – CAP example

DIAGNOSTIC MODE

Allowed us to debate

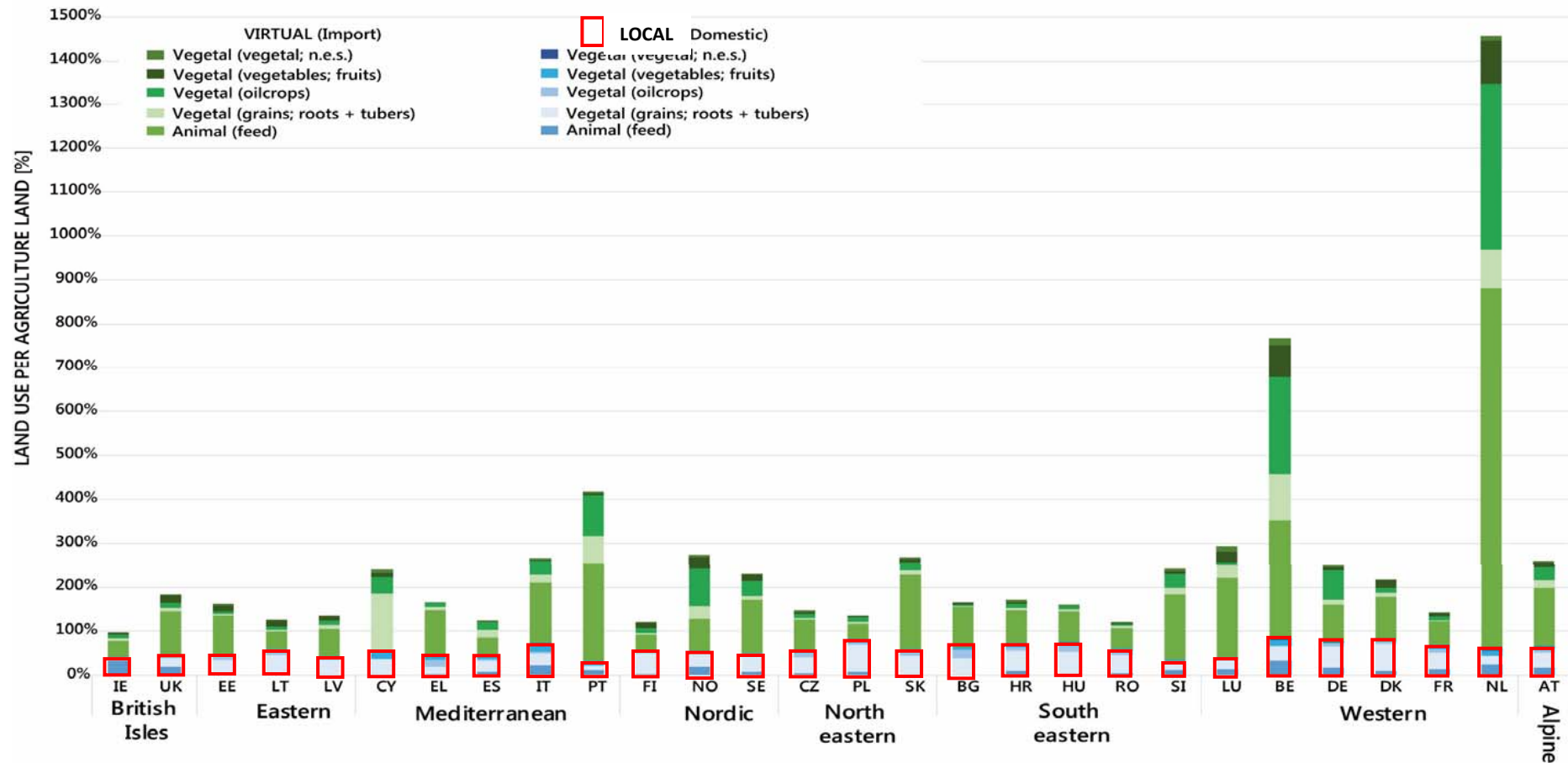
- Biophysically feasible, in long-term?
- Technologically and economic viable, in long-term?
- Desirable? If not, what needs to change?



What if the EU had to produce all its own food?

ANTICIPATION MODE

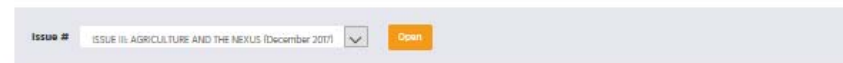
LAND – local vs virtual



# MuSIASEM as Post-Normal Science

- WEFE nexus “security” highlights strong sustainability as urgent and intractable
- Scientific practice and products can be political
- Need to fully consider how the SDGs deliver benefits, to whom and where
- All analysis is partial – trying to be as holistic as possible
- Conveying complexity and trade-offs to enable, not disable, policy making

<http://www.magic-nexus.eu/nexus-times>



## What are the tradeoffs in agriculture?

By The Magic Nexus team

Why is the MAGIC project specialized on the water-energy-food nexus? Because the nexus matters crucially for many EU policies! In this issue, we discuss some of the nexus issues that concern agriculture and the challenge of feeding an increasing population.



## The WEFE Nexus and the Common Agricultural Policy

By Keith Matthews

The MAGIC Nexus project team has identified policy narratives that illustrate complexities and tradeoffs regarding the European Union's Common Agricultural Policy (CAP) in the context of the water, energy, food and environment (WEFE) nexus. The importance of the Nexus for the Common Agricultural Policy



## Planetary boundaries and the global food system: what about the farmers?

By Louisa Jane Di Felice, Mario Giampietro, Tarik Serrano-Tovar

Planetary boundaries are usually framed in terms of natural constraints on the ecosystem, but constraints linked to society's organization, especially our workforce, shouldn't be ignored.



## The land sharing vs. land sparing debate: Options to ensure food security while preserving biodiversity

By Raimon Ripoll Bosch, Akke Kok and Evelien de Olde

Global agricultural production is increasing to meet our food needs as the world's population grows - but how can this expansion be reconciled with environmental concerns such as biodiversity loss and cultural practices?



## VIDEO: How should we conceptualize 'food'?

By Mario Giampietro

Should we view the concept of food more in terms of its historical and geographical context versus its role as a commodity? Mario Giampietro of the UAB explains why the definition of 'food' is so important when analyzing agricultural systems. This excerpt was taken from the 2017 UAB MOOC on socio-ecological systems.



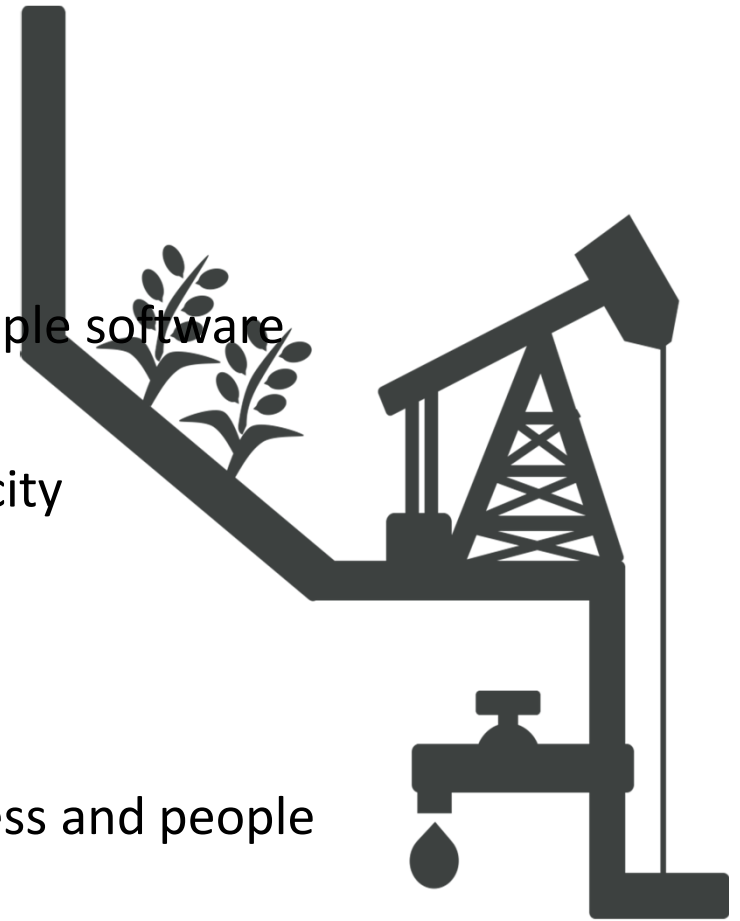
## VIDEO: Is agriculture just about food production?

By Mario Giampietro

Watch Mario Giampietro talk about the complexities of agriculture and how farming is more than just monoculture. This excerpt was taken from the 2017 UAB MOOC on socio-ecological systems.

# The magic of Magic

- Not a tool – no user friendly interface or simple software
- Requires immersion, commitment and tenacity
- Challenging to use and to explain
- An approach that focusses on context, process and people
- A flexible accounting framework that works across scales and with non-equivalent variables
- Identifies ‘known unknowns’ in evidence-based policy





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# The MAGIC-NEXUS Project

Finding new ways to tackle complex policy issues at the nexus between water, energy and food resources

<http://magic-nexus.eu/>

<https://www.facebook.com/MagicNexusEu/>

#MAGIC\_NEXUS

Video Series on Uncomfortable Knowledge:

<https://www.youtube.com/playlist?list=PLIZrkdjNiMaWa0Gq3RT2NRQHPTkrARVmH>

