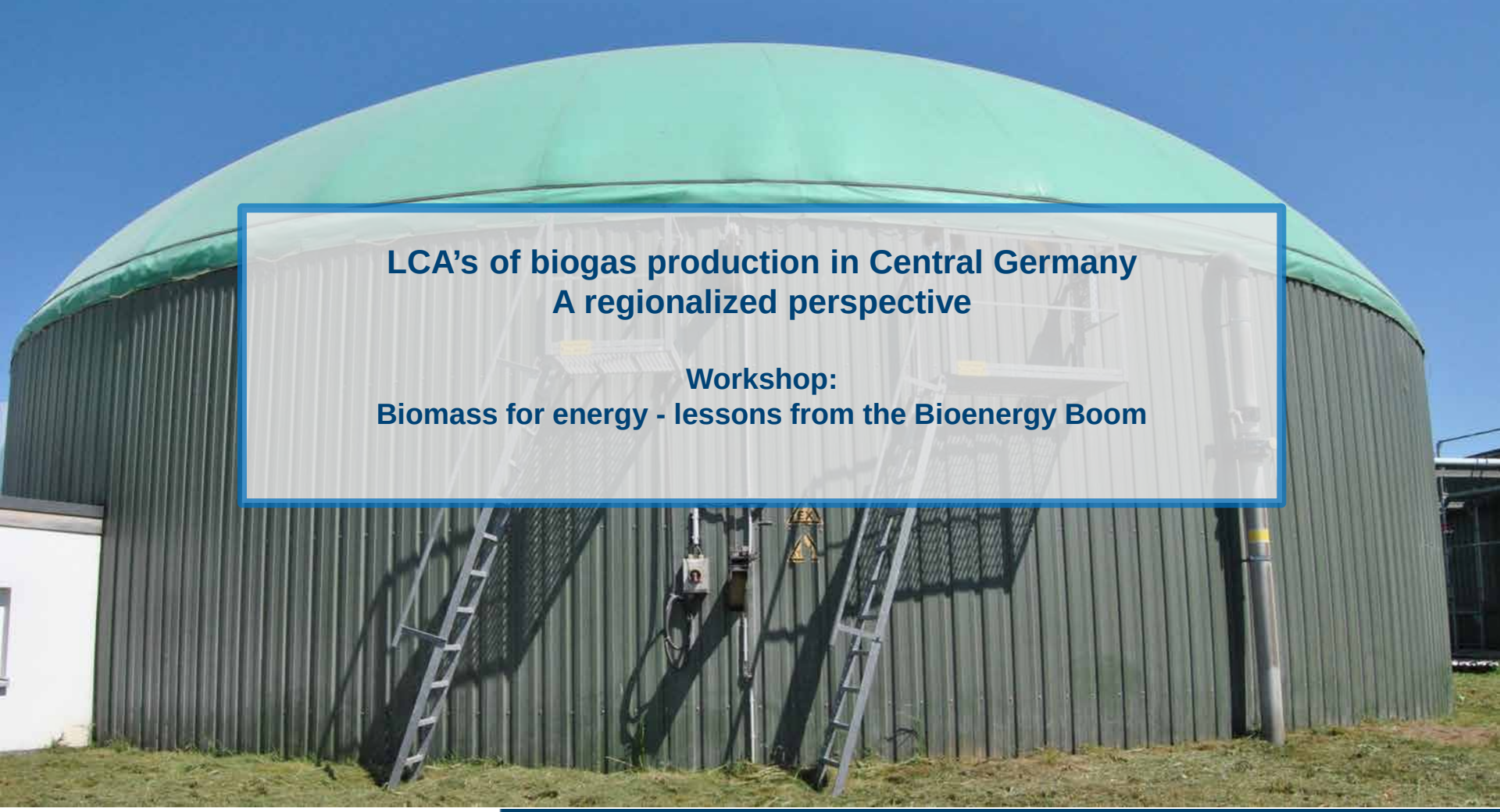

LCA's of biogas production in Central Germany
A regionalized perspective

Workshop:
Biomass for energy - lessons from the Bioenergy Boom

Steffen Schock, Alberto Bezama, Daniela Thrän

24-25 November 2014

KUBUS, Leipzig, Germany

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Overview

- Introduction
- Concept & case study: A regional life cycle approach in “Central Germany”
- Results
- Outlook & conclusion

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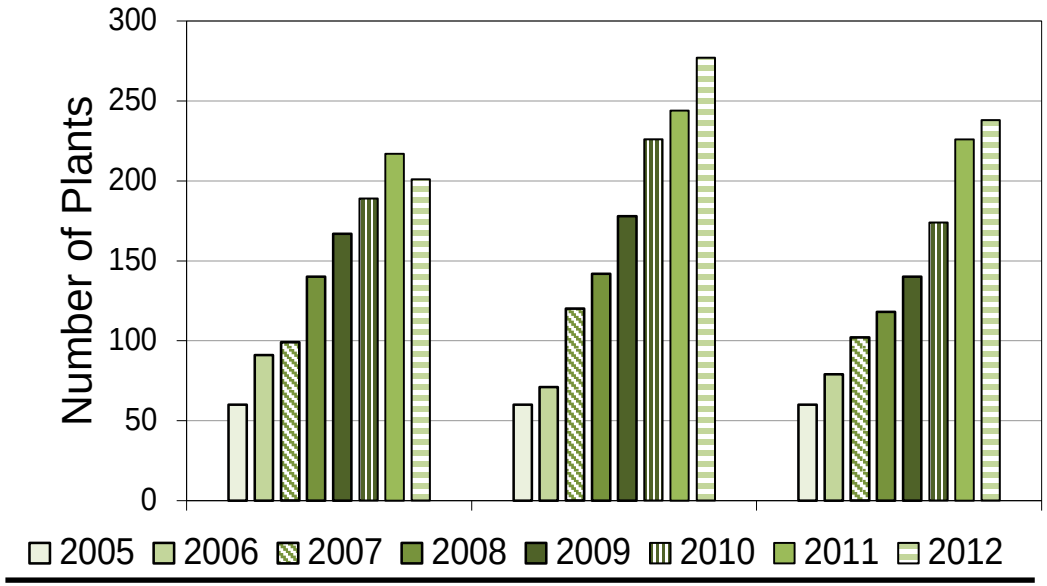
Introduction: Biogas development in central Germany



Significant biogas plant infrastructure

Electricity generation from Biogas

	2010	2011	2012
	Mio. kWh		
Saxony	540	660	850
Saxony-Anhalt	670	890	1.150
Thuringia	480	610	790

Share of Biogas-electricity from gross electricity production

	2010	2011	2012
	%		
Saxony	1	2	2
Saxony-Anhalt	3	4	5
Thuringia	7	8	10

Data Source: DBFZ, ZSW

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Introduction: LCA's for biogas production

§ Many LCA studies in the recent years on biogas production

à Large variation of results

à Hard to simplify

§ Different reasons for the variations:

- Methodological differences
  - Functional Unit
  - System Boundaries
  - Methodological Assumptions
- Complexity of natural systems

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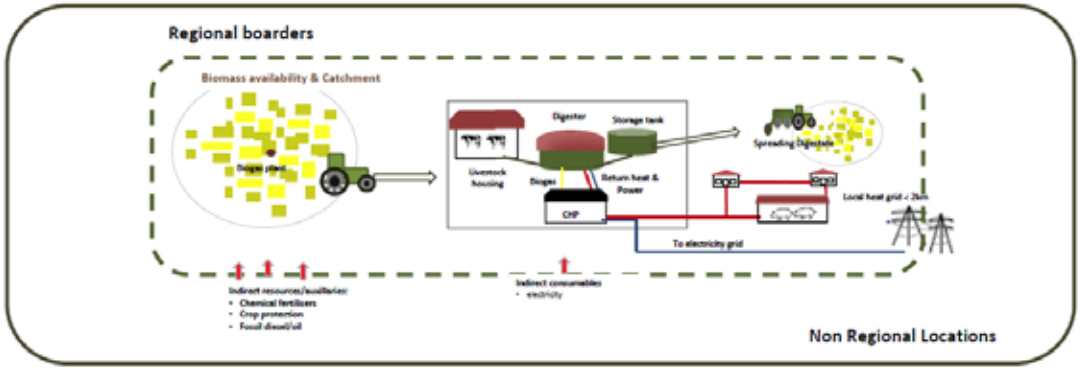
Problem related to agricultural biogas production

What to do if we want to…

- Analyze displacement effects on a system level
- Identify optimization potentials on a regional/larger level
- Comparisons of the environmental performance and identification of improvement potentials between regions



Source: O'keeffe

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Assessing agricultural biogas systems

…struggling with the heterogeneity/complexity of natural systems

- Dependence of the output complex in relation to the input
- Variability of input data
- System boundary not clear defined

Diffuse nature of agricultural biogas production

Combination of different technical options

Source: Wikipedia-CC-BY-SA-3.0-de

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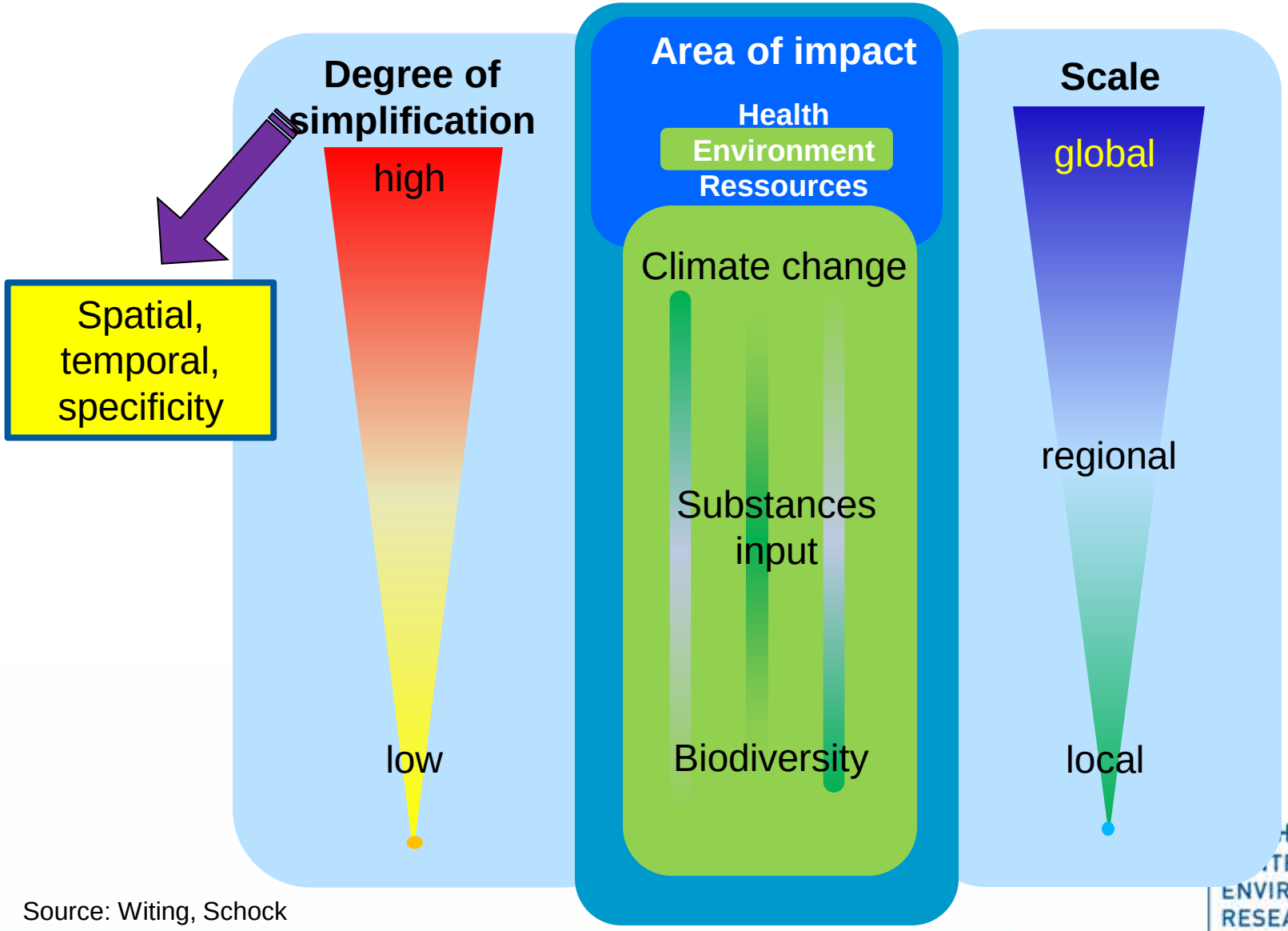
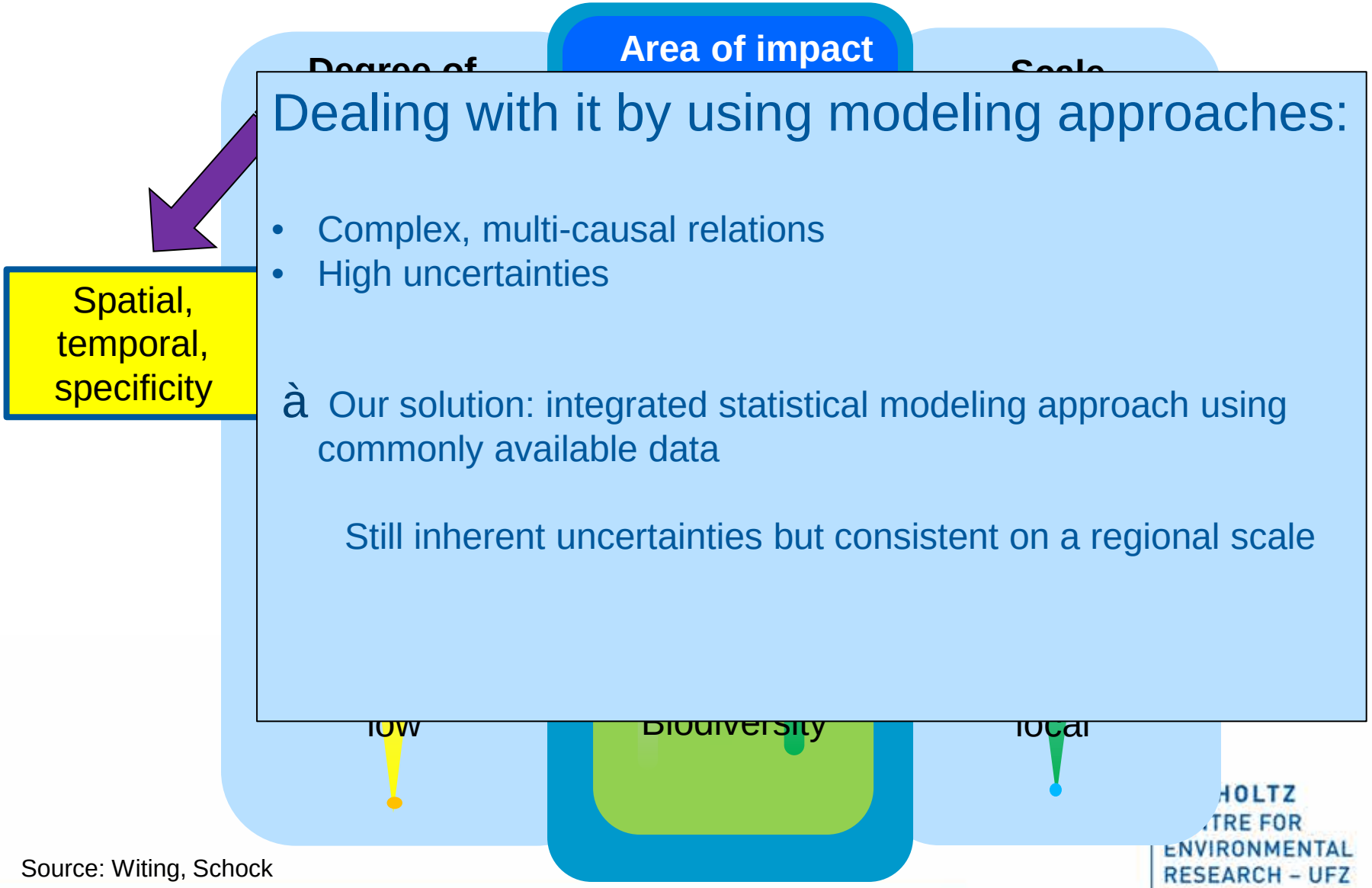
Environmental assessment: Problem of scales



Source: Witing, Schock

Environmental assessment: Problem of scales



Dealing with it by using modeling approaches:

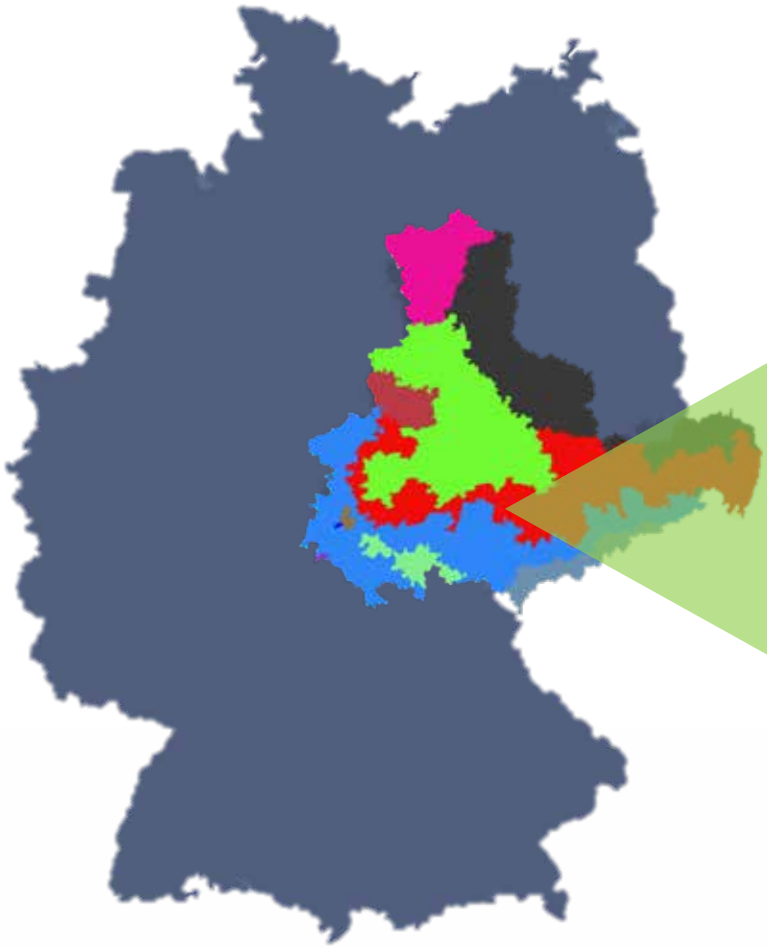
- Complex, multi-causal relations
- High uncertainties

à Our solution: integrated statistical modeling approach using commonly available data

Still inherent uncertainties but consistent on a regional scale

Source: Witing, Schock

Case study “Central Germany”: Spatial delimitation



- Agro-climatic Regions (Roßberg et al.)
- Homogeneous agricultural production regions

Picture source: Flickr / mgrenner

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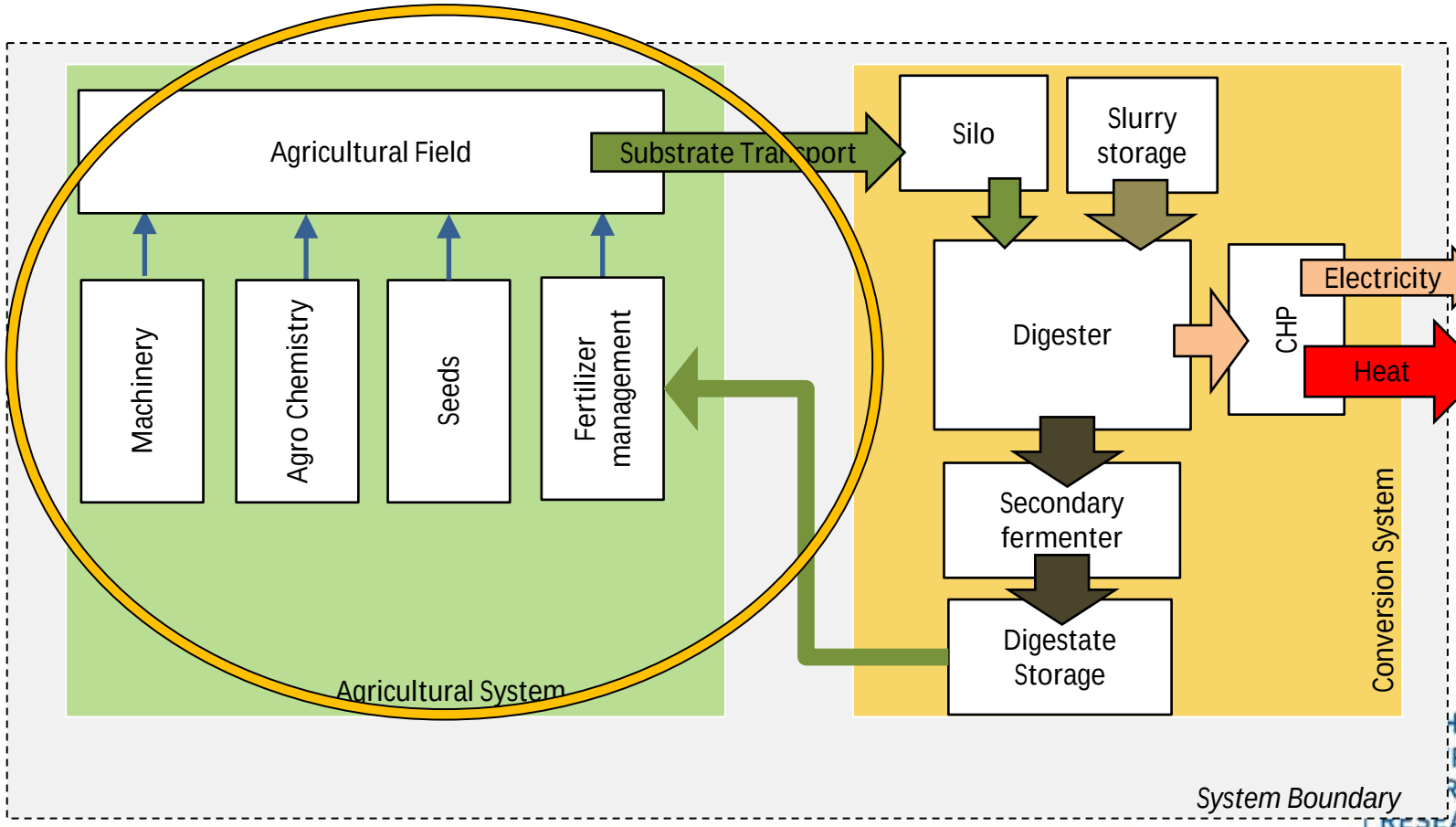
System description

- For each subsystem development of a parameterizable, generic production module

Two staged inventory process



Picture source: flickr / tuxdriver

The concept: Agricultural production

Regional Statistics

Geo-Data

Farm typology

- Farm management
- Cropping systems
- Nutrient balances


Winter Wheat


Maize


Winter Rape


Winter Barley


Spring Barley


Winter Rye


Sugar Beet


Grass

LCI - Datasets

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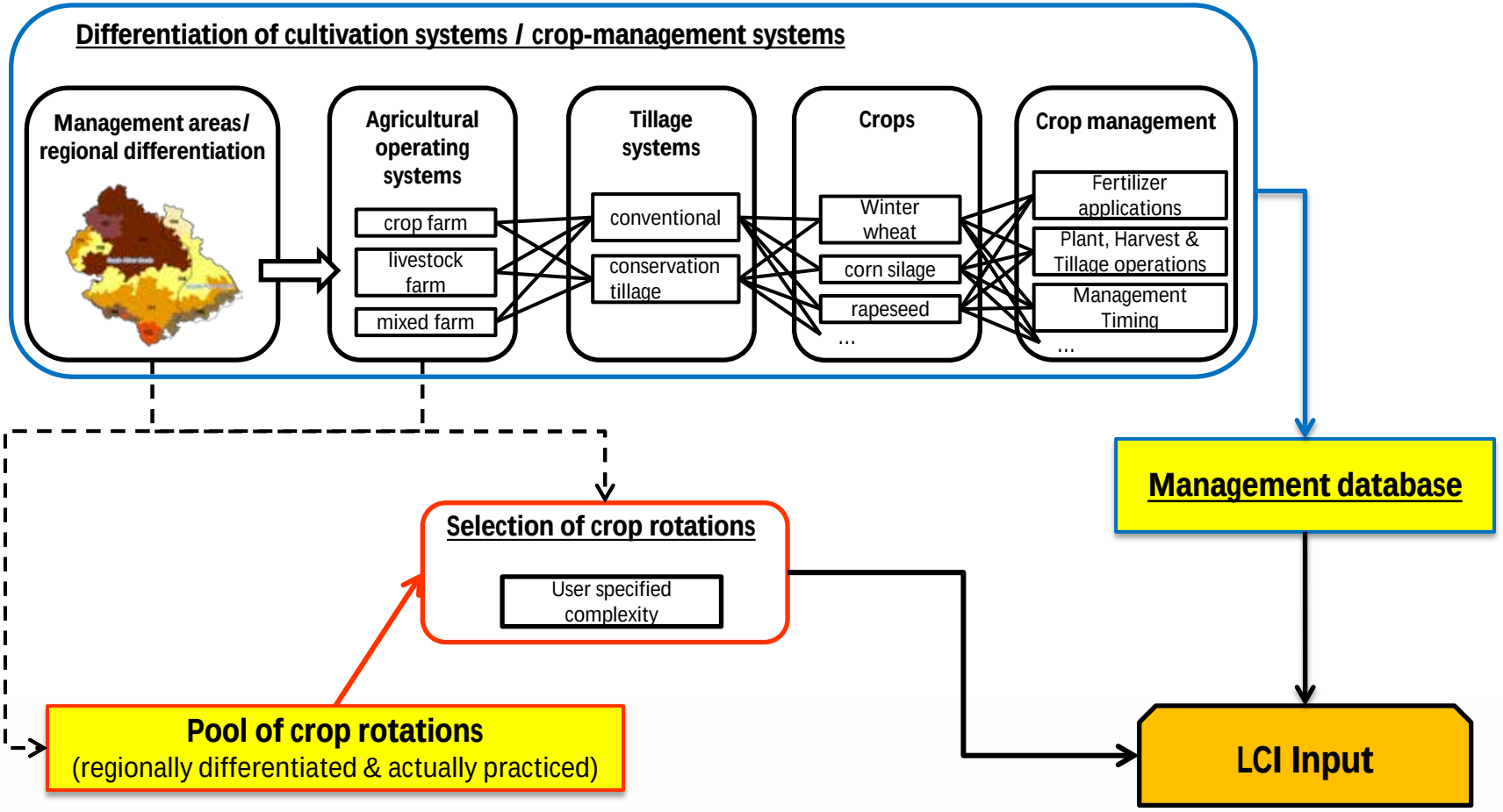
Case study: Agricultural inventory



Source: Witing et al

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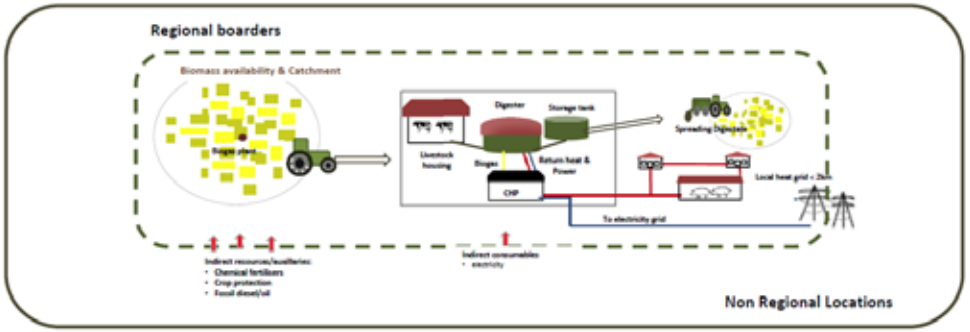
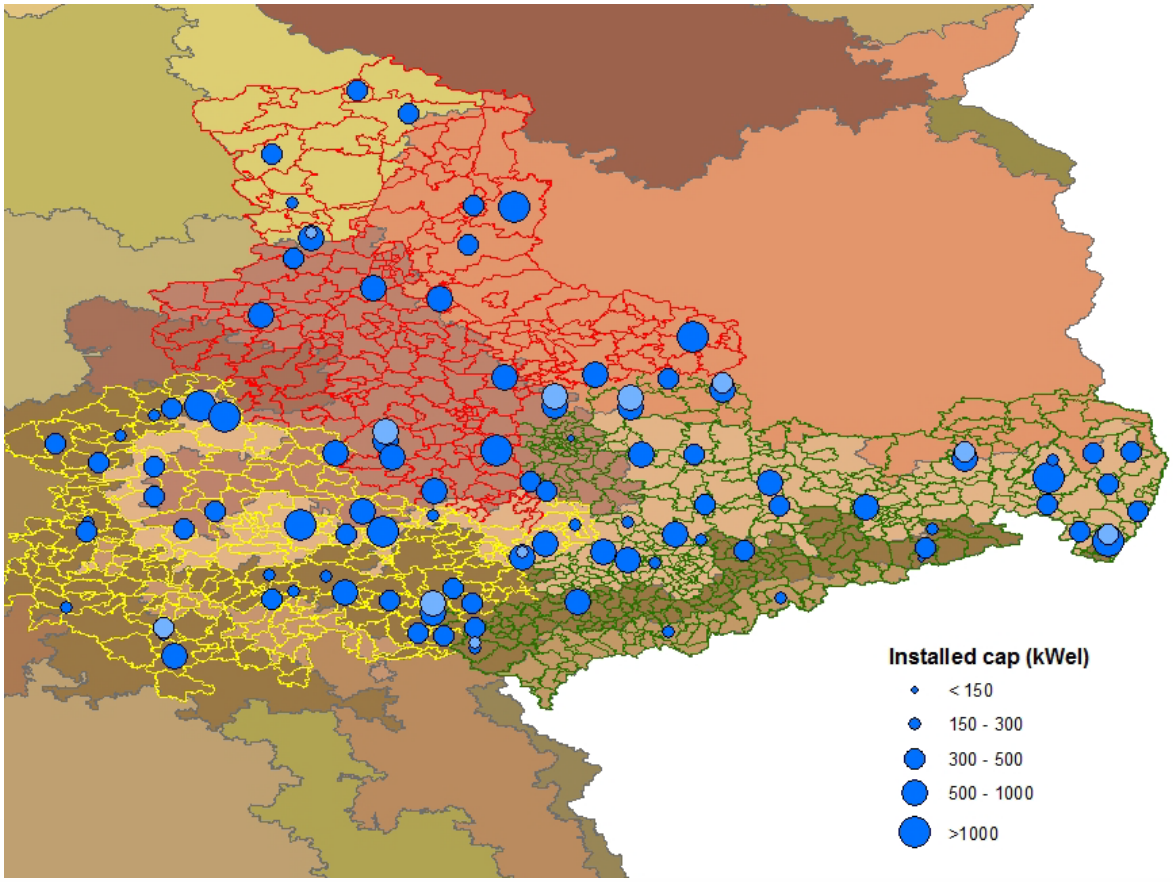
System description



Agricultural Field
Substrate Transport
Machinery
Agro Chemistry
Seeds
Fertilizer management
Agricultural System
Silo
Slurry storage
Digester
CHP
Electricity
Heat
Secondary fermenter
Digestate Storage
Conversion System
System Boundary

Picture source: flickr / tuxdriver

Case study: Biogas in „Central Germany“



Data source: DBFZ

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Case study: Plant inventory

§ Technical Data: DBFZ Biogas-Database (Germanwide survey)

- Efficiencies
- Heat usage
- Operating hours
- …

§ Data gaps: Literature / Expert opinion

Source: Martina Nolte / CC-BY-SA-3.0-de

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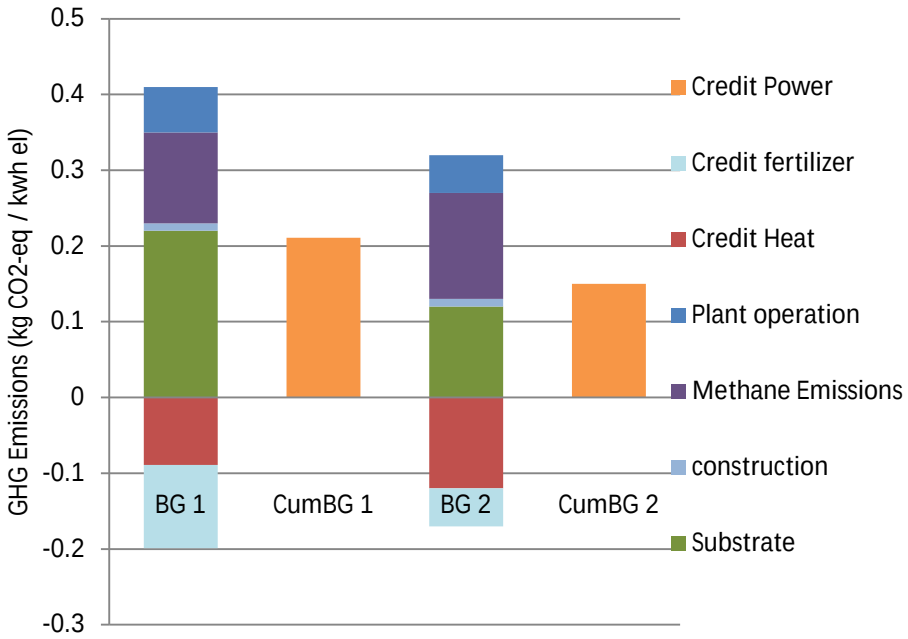
Some preliminary results of biogas production (GHG)



Sample plants:

- BG 1
  - Saxony
  - ~500 kw
  - Silage/ Cattle Slurry
- BG2
  - Thuringia
  - ~250 kw
  - Pig slurry /silage

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Discussion & conclusion (1)

- Biogas is contributing to GHG emission reduction, amount varies
- Regional variability can be captured by applying the developed approach
- For the full picture - full LCA (inclusion of other local Impact categories)
- Level of regionalization – strongly dependent on the scope

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Discussion & Conclusion (2)

- The development of regionalized impact categories can add substantially to the accuracy of the results (especially in combination with GIS)

- In the context of bio-economy – regionalization is important for the sourcing of agricultural substrates

Thank you!

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Thank you!

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