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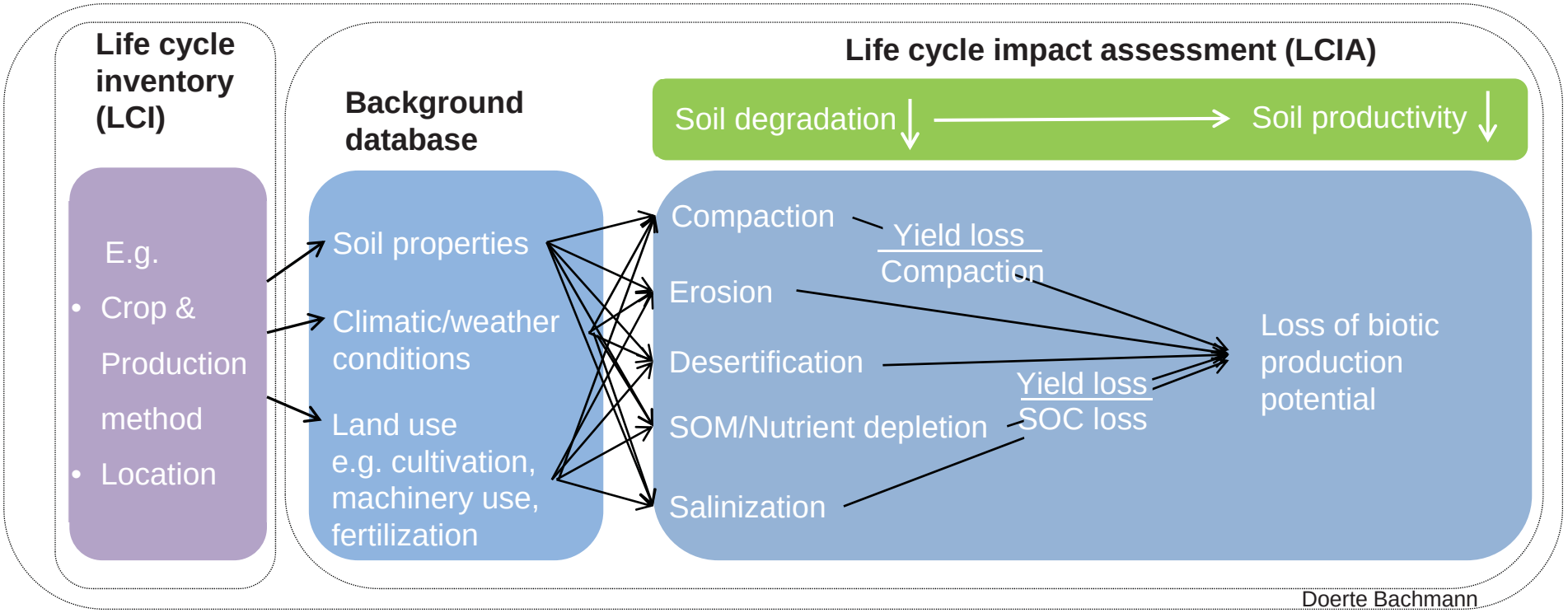
Life cycle impact assessment (LCIA) of soil degradation: Development of a new impact assessment method

Introduction

- Most important **soil functions**:
  Production of biomass, harbouring biodiversity, physical environment for humans, source, filter and storage of nutrients and water
- Reduction of soil quality globally
- Most important **soil degradation processes**:
  Soil erosion, decline of soil organic matter, soil compaction, soil salinization, desertification, soil sealing, landslides and soil contamination

→ Inclusion as indicator in life cycle assessment

Framework soil degradation



Soil compaction «own model»: Data

- Crop growing data: Combination of crop and management system. Record of all machine operations during one growing cycle.
- One example of dataset is the data from the Deckungsbeitragskatalog of Agridea.
- Flexibility of the model: the data is easily to adapt, e.g. with the bigger dataset of KTBL, own data or data from ecoinvent


Poettinger.at

Soil compaction «own model»: Data

- Machine data:
  Specification of the working equipment (source: specifications of machine producer, Terranimo model or scientific publications)
- Flexibility of the model:
  The specification of the machines used are dependant on the degree of mechanisation of a region → adaption with e.g. mechanisation data of the FAO or own data

traktorpool.de

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Soil compaction «own model»: Data

- Soil texture: Soilgrids1x1km provide worldwide data (SOM content, pH, texture, soil skeleton, bulk density and cation exchange capacity in different soil depths) from several soil mapping projects and are assembled by ISRIC World Soil Information

- Flexibility of the model: Use of higher resolved soil texture data of a specific region

Soil compaction «own model»: Data

- Soil moisture: Currently the compaction model uses soil moisture levels 1 - 5
- Upgrade of the model: Using soil moisture data of a simple soil moisture model (René Orth) in 0.5°x0.5° resolution and daily intervals

wetterstation-göettingen.de

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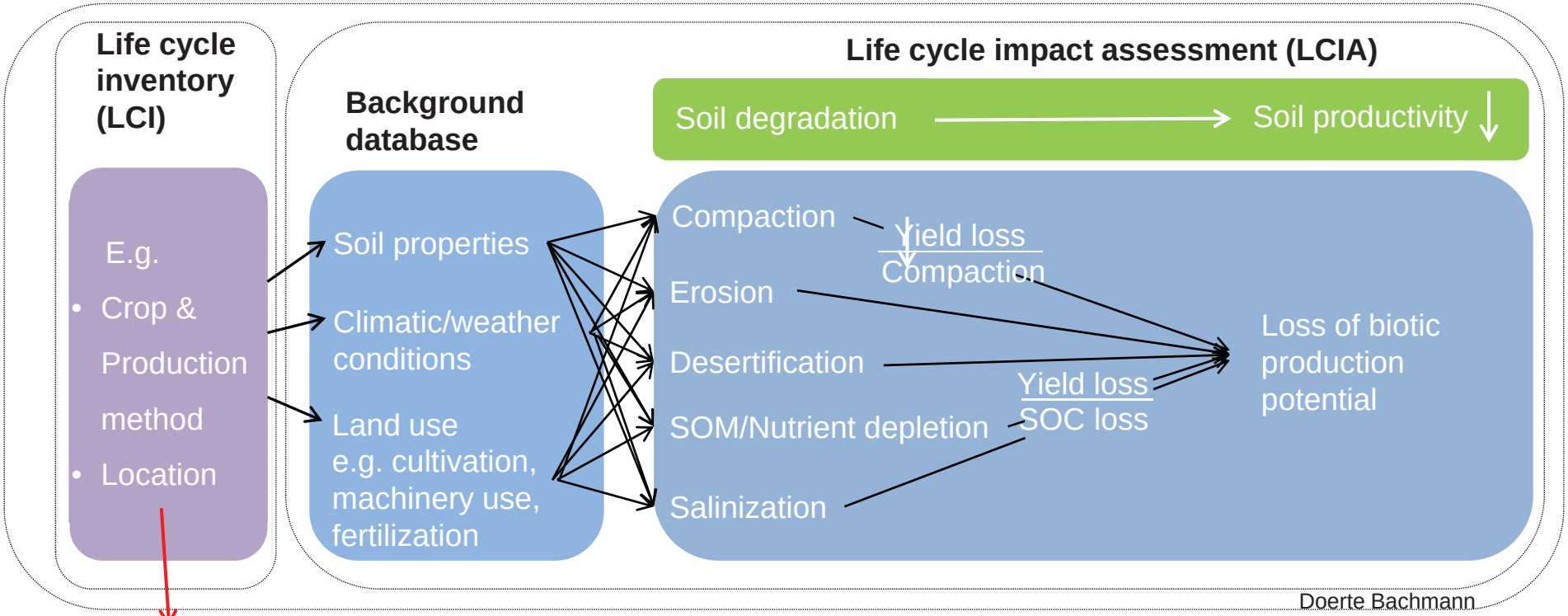
Framework soil degradation

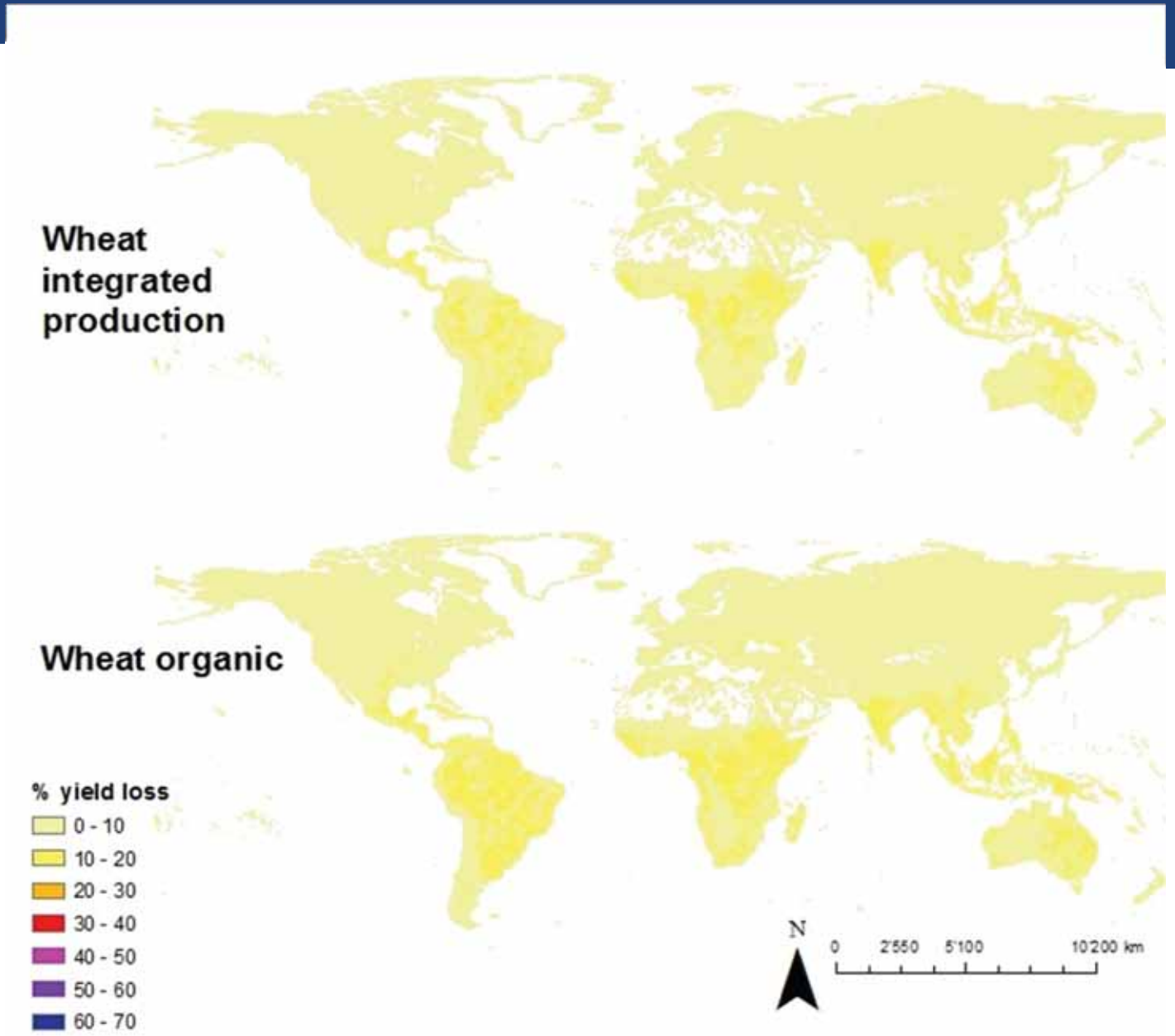


Wheat
- integrated
- Organic

- on the world

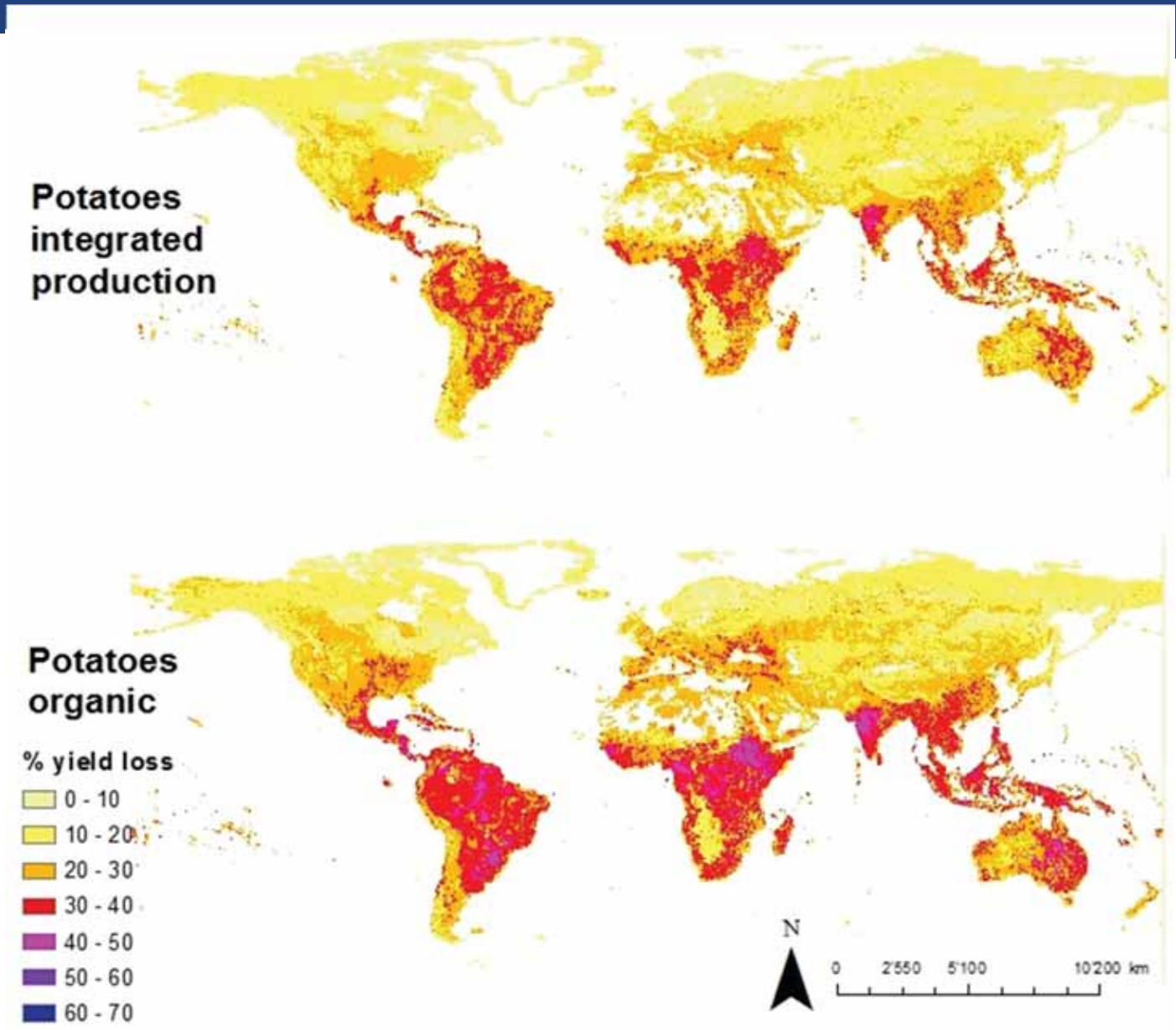
Short term yield losses

Assumption: high soil moisture

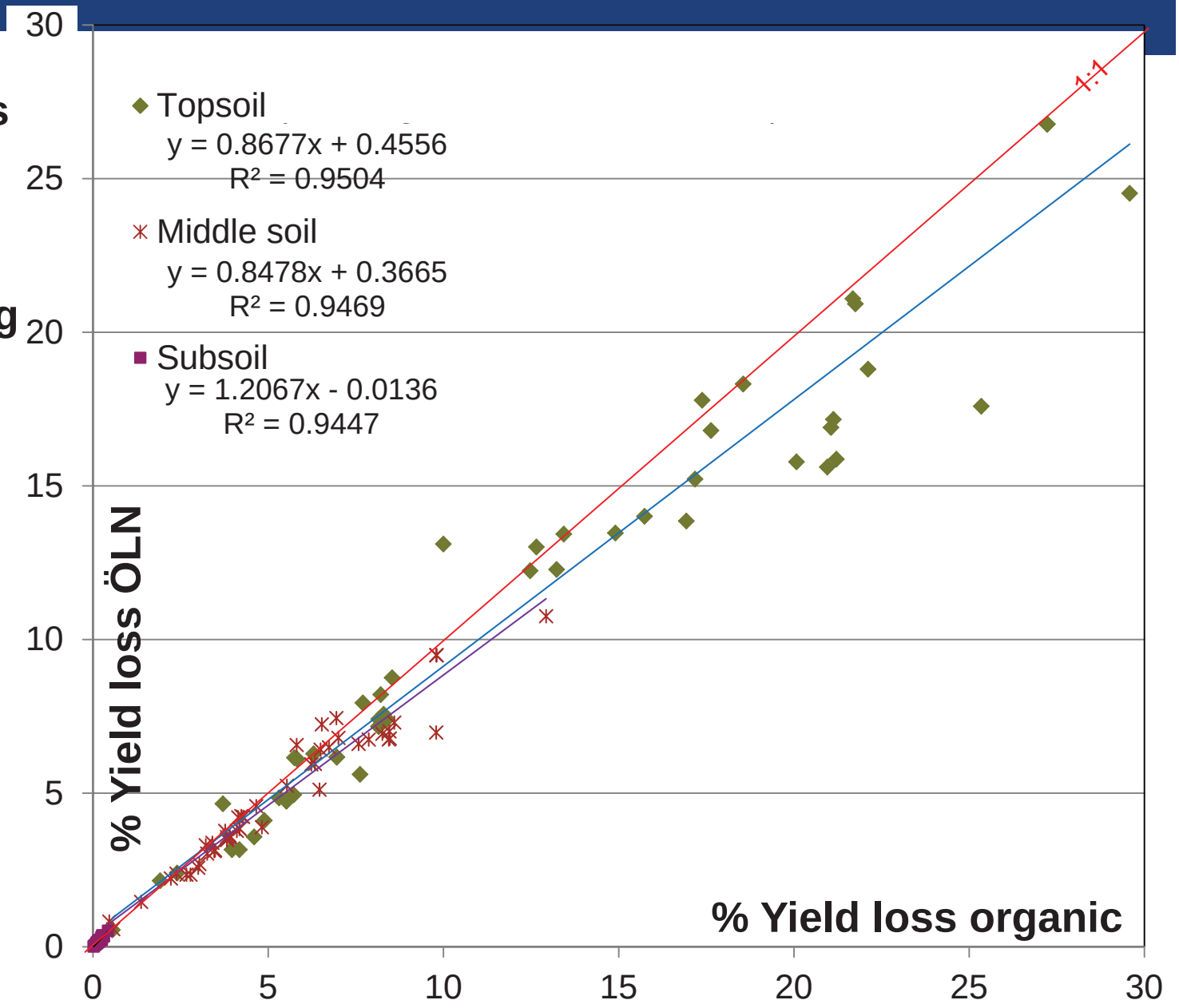


Short term yield losses

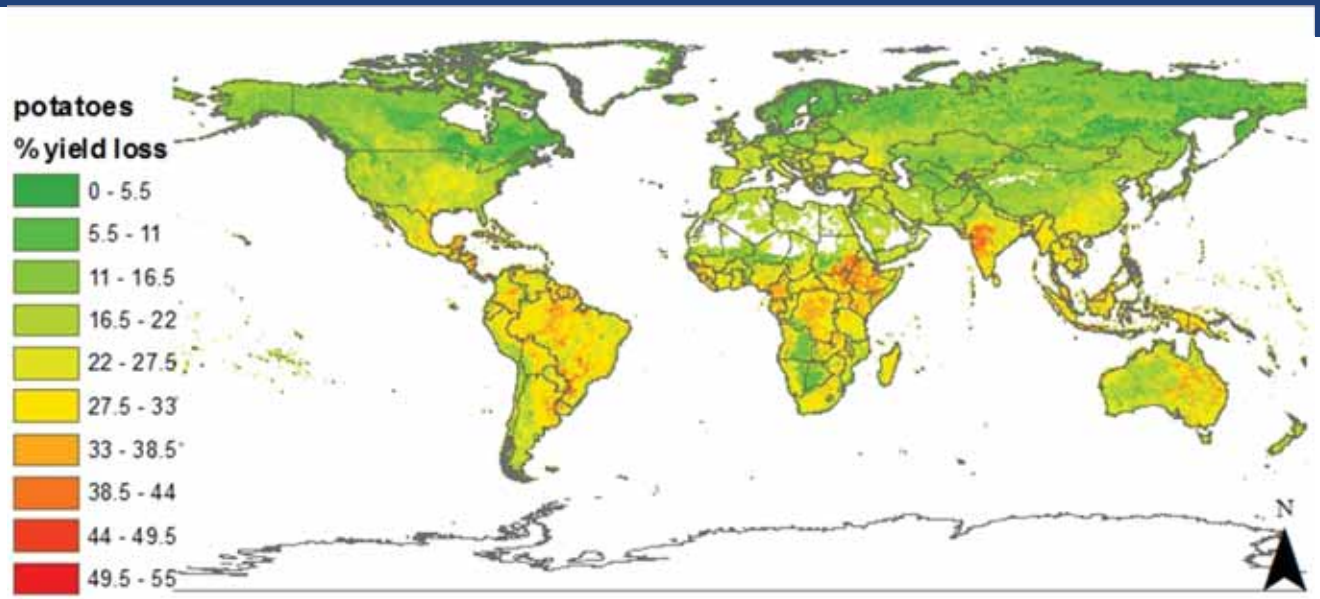
Assumption: high soil moisture

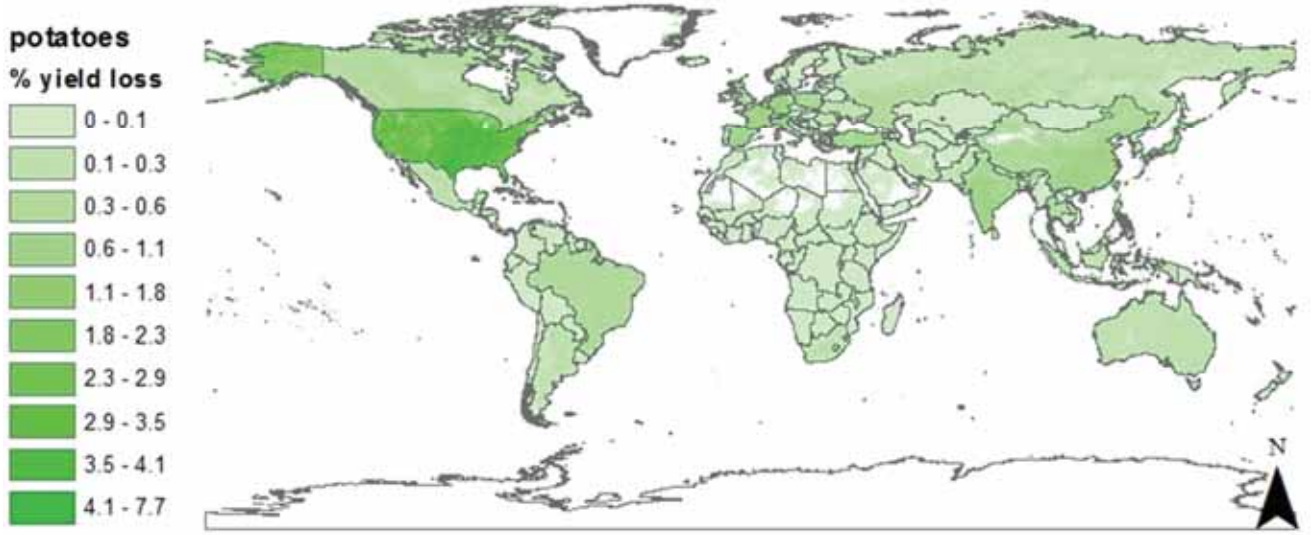


Comparison of the impacts among organic and the corresponding integrated production

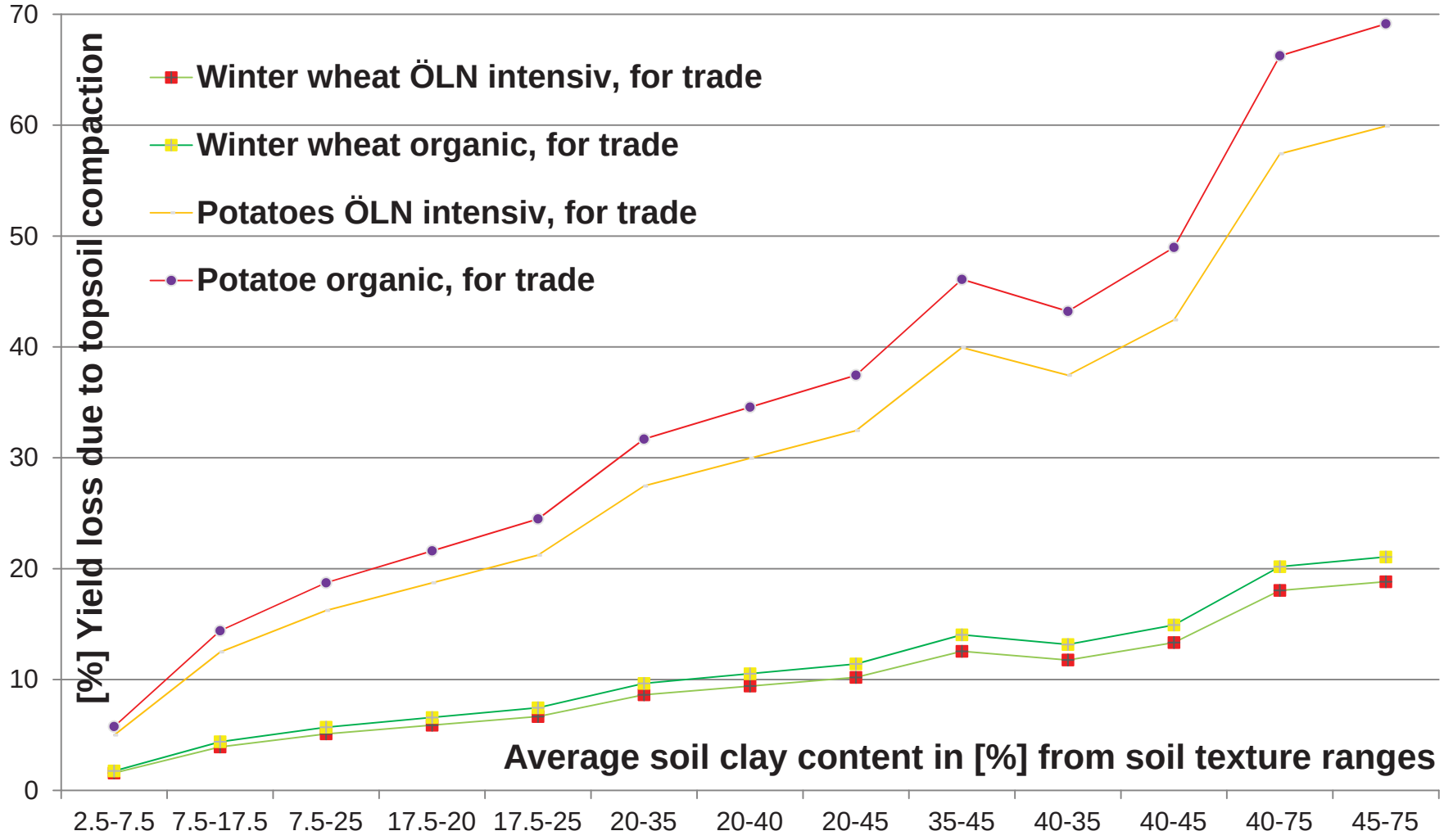


Impact of potatoes with the adaption of the machinery according to the mechanisation data of the FAO





Influence of the soil texture on yield loss due to compaction with the assumption of high soil moisture



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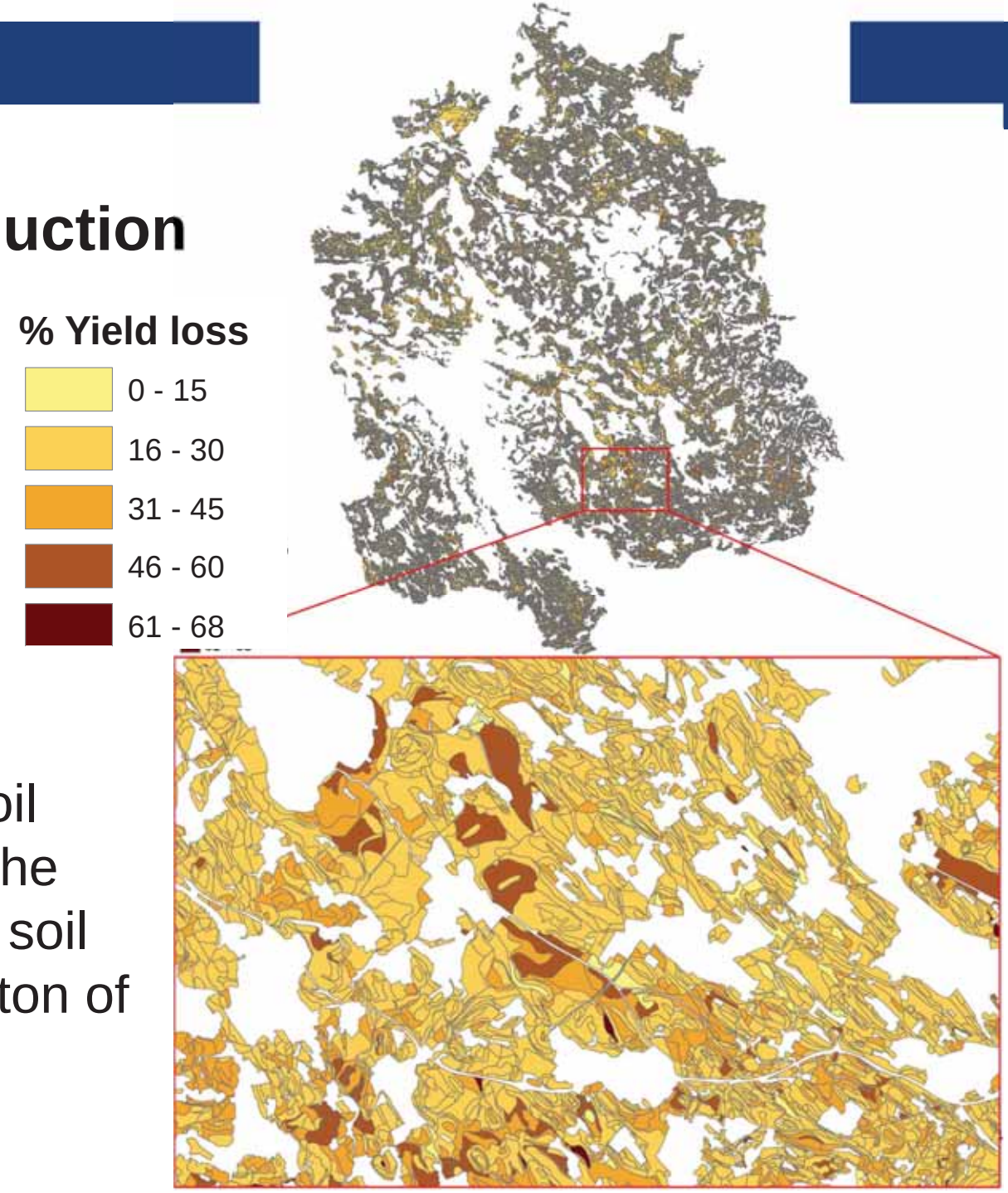
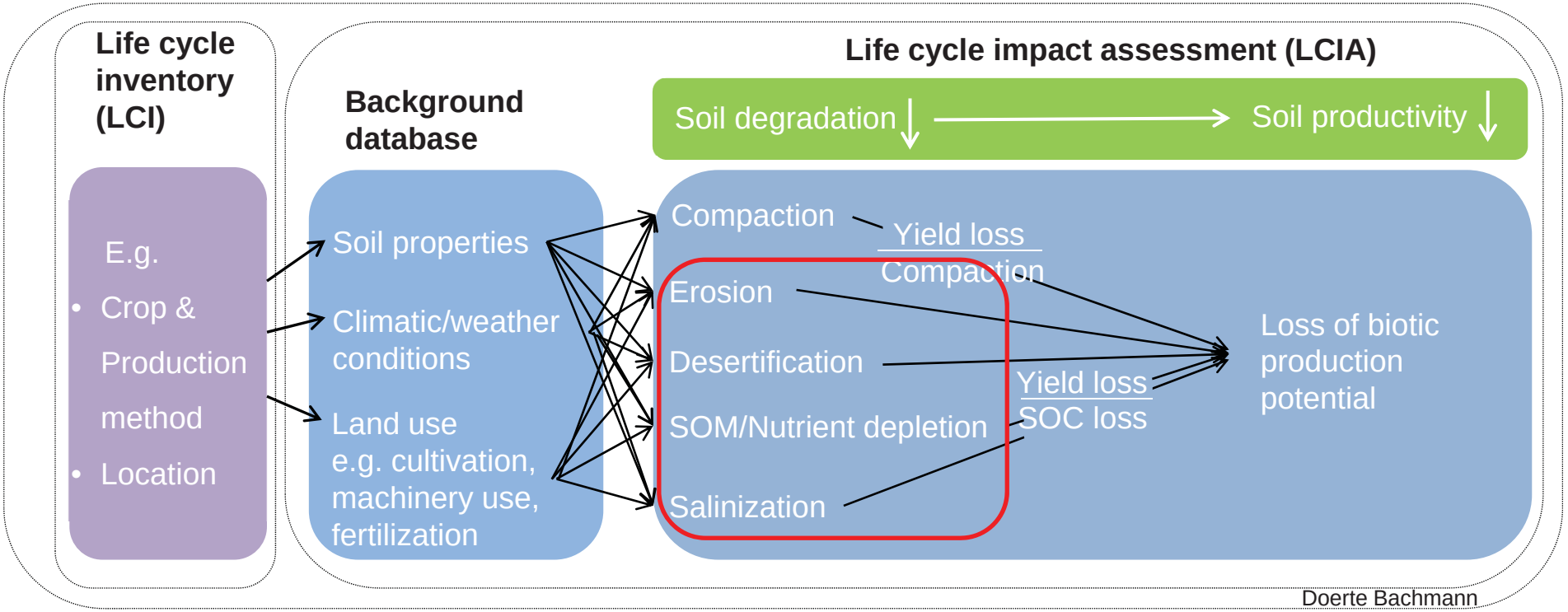
Potatoes from integrated production



Impact due to topsoil compaction under the assumption of high soil moisture in the canton of Zurich

ESD ecological systems design www.ifu.ethz.ch/ESD

Completion of the concept



- Lean on methods developed and further elaborate them to our concept

Conclusions

- The difference of the compaction impacts between diverse **crops** are considerable
- **Soil texture** and **soil moisture** do vary the results considerably
- The difference of the compaction impacts between organic and integrated agricultural productions are small

Thank you for your attention and I'm happy to answer your questions.

franziska.stoessel@ifu.baug.ethz.ch

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