

# Ecosystem services driven by soil biota – understanding, valuation, and management – the **SoilMan**-Project



Foto: Joergensen

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## SoilMan is research on the provisioning of ecosystem services by soil biota:

### Understanding:

- Getting to know what measures support or detract soil biota and their performance.
- Getting to know the extent of impact: Who is doing what and how much?

### Valuation:

- Translating the impacts of soil biota into values for production, environmental and human health and well-being.  
What is worth an earthworm for the people (the societies)?

### Management: ideas and recommendations for soil biota supporting

- soil management measures (farm level)
- governance tools (EU, policy level)

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## Why SoilMan? Why is soil biota so important?

- Soil biodiversity is often overseen!
- Soil biodiversity is hard to communicate due to its complexity
- Soil biodiversity provides essential services for soil fertility
- Sustainability of farming systems depends on soil functions
- and soil functions depend on soil biota
- Soil biota can exemplify that nature is a farmers companion

## The basic two attitudes (faces) of agriculture vs. nature or environment

### Nature as the **companion** (mutualism)

- reading nature
- taking advantages from provided services
- Production within the ecosystem
- Human activity as a part of the environment (as an ecological expression)

### Nature as the **enemy** (competition)

- dominating and controlling nature
- minimize production risks
- exclude nature to exclude uncertainties
- replacing ecosystem functions with technical and artificial processes and measures

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**Naiv!**

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**Ignorant!**



Based on this ....

Also **sustainable agriculture** has two understandings

The environment and social friendly understanding:

- Ensure ecological and social functioning
- Respect to nature, people, tribes, gender, creatures, and more
- Sustainability driven by political correctness and **renunciation**

The technical and engineering friendly understanding:

- Ensure technical progress
- Ensure innovations, inventions, and investments
- Sustainability driven by **economic growth** and welfare development

## Important attributes.... of sustainable agriculture in the two boxes

The environment and social friendly understanding:

- Low input systems
- Organic farming
- Carbon sequestration
- Biodiversity
- Getting regional
- No tillage
- Envi-Certifications

The technical and engineering friendly understanding:

- Progress in agronomy
- Progress in plant protection
- Progress in breeding
- Increasing yield, efficiency and added values in farming systems

## But .... There are limits ..... however!

An example: Breeding potentials .....and agronomic realization

Linear yield trends (% per year) (Laidig et al. 2014)

	genetic	agronomic
summer wheat	0.49* ↗	0.05 →
winter wheat	0.66* ↗	0.20 →
sugar beet	0.60* ↗	1.04* ↗
oil seed rape	1.42* ↗	0.05 →
maize (silage)	1.12* ↗	-0.65* ↘
maize (grain)	1.80* ↗	-0.35 ↘

Summarised by Taube 2018

## Future agriculture needs both perspectives

- Provision of ecosystem services
- Balancing pests and benefits
- Attention and care for organisms
- Learning and taking over
- adapting and/or utilisation of the biological functional settings

### **Conclusion:**

- Soil biota and sustainability in land are linked
- Soil biota has a strong impact
- Perspectives on intensification vs. extensification are society driven
- We need to think out of the box

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**Ecological Intensification**

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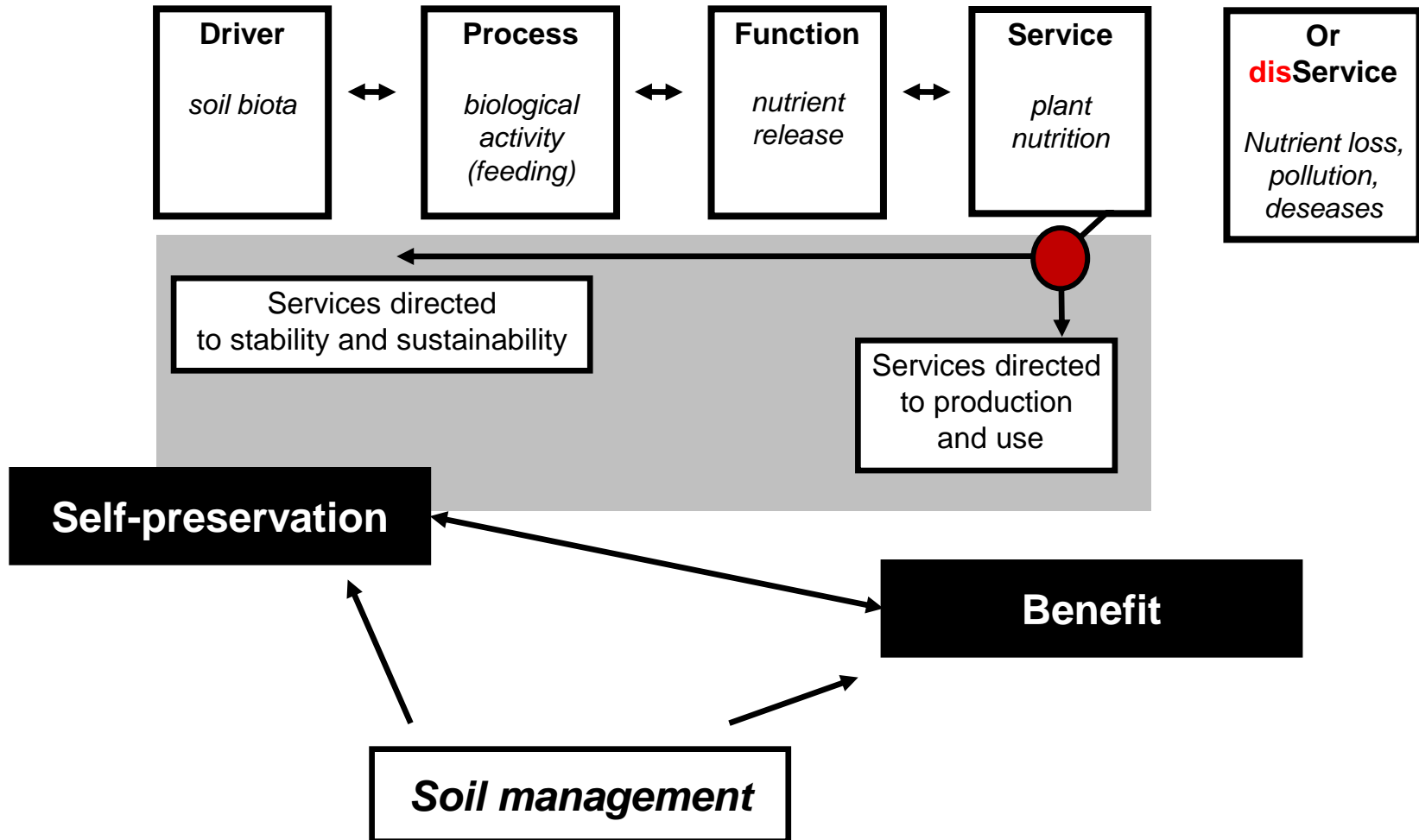
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**Ecological Intensification with soil biota**

# Services and disservices as a basic conception for the biological impact



## **So.....what services are we talking about:**

- **Decomposition .... plant nutrition ..... carbon sequestration**
- **Perforation ... biopores ... infiltration .... soil airation**
- **Aggregation ... no erosion ... less compaction ... fertility**
- **Suppression .... of pathogens .... less deseases .... crop health**
- **Repression .... of pathogens and toxins .... good quality**
- **Bioturbation .... biological tillage ..... soil fertility**



## What is worth an earthworm?



A highway making use of the service of soil aggregation provided by earthworms

## What is worth an earthworm?



**A highway not making use of the service of soil aggregation provided by earthworms**



## with earthworms



## Without earthworms



Fotos: Pixbay/ spiegel online und Stephan Brand, Landesbetrieb Landwirtschaft Hessen LLH

- Soil biota indicates and **drives** sustainability in land use
- Research has to handle a huge complexity
- Simplifications are risky
- The conception of ecosystem services can help to integrate the production and the ecosystem perspectives

Fotos: Pixbay/ spiegel online und Stephan Brand, Landesbetrieb Landwirtschaft Hessen LLH

## Main tasks for SoilMan

- Broadcast soil biota as the driver of services and intrinsic soil health.
- Elevate soil biota from a ‘biodiversity goal’ to the ‘farmer’s engineering companion’.
- Integrate soil biota into best practice suggestions and management recommendations.
- Break down *adoption barriers* via stakeholder involvement.



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