# Making soil protection goals based on the ecosystem services concept operational in ecotoxicological risk assessments

*On behalf of ECPA:*

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# Soil is special

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- Soil delivers important ecosystem services (EsS)
- Biodiversity close to endless
- “The black box soil”
- Soil is very heterogenic

| Taxa | Number of Individuals per foot print |
|---|---|
| Bacteria | $10^{12} – 10^{14}$ |
| Fungi | $10^{9} – 10^{12}$ |
| Algae | $10^{6} – 10^{9}$ |
| Protozoa | $10^{7} – 10^{9}$ |
| Nematodes | $10^{4} – 10^{6}$ |
| Mites | $2 \cdot 10^{2} – 4.10^{3}$ |
| Springtails | $2 \cdot 10^{2} – 4 \cdot 10^{3}$ |
| Earthworms | up to 5 |

**Protection of soils is not an easy task**

# General Protection goals

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## Thematic Strategy for Soil Protection

*“Soil stores, filters and transforms many substances, including water, nutrients and carbon.” “These functions must be protected”*

## EU Biodiversity Strategy

“*To halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020*”

## Chemical regulations require

No “*unacceptable*”, “*undesirable*”, “*harmful*” or “*adverse effects*” on “*biodiversity*”, “*ecosystems*” or “*the environment as a whole*”

**Ecosystem services, functions and biodiversity**

# Specific protection goals

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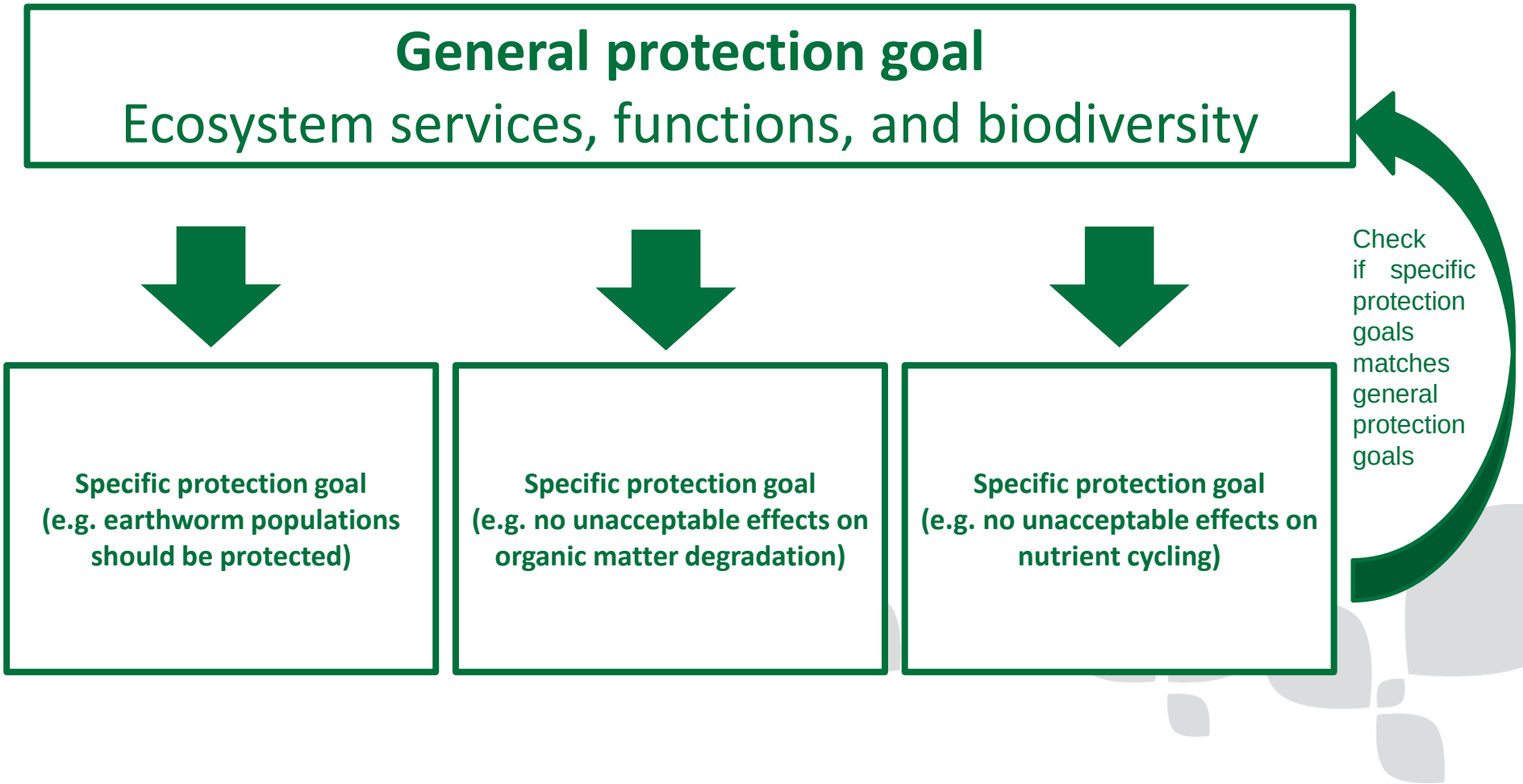
- **General protection goals need to be translated into specific protection goals**



# Protection goals
# -The start of every risk assessment-

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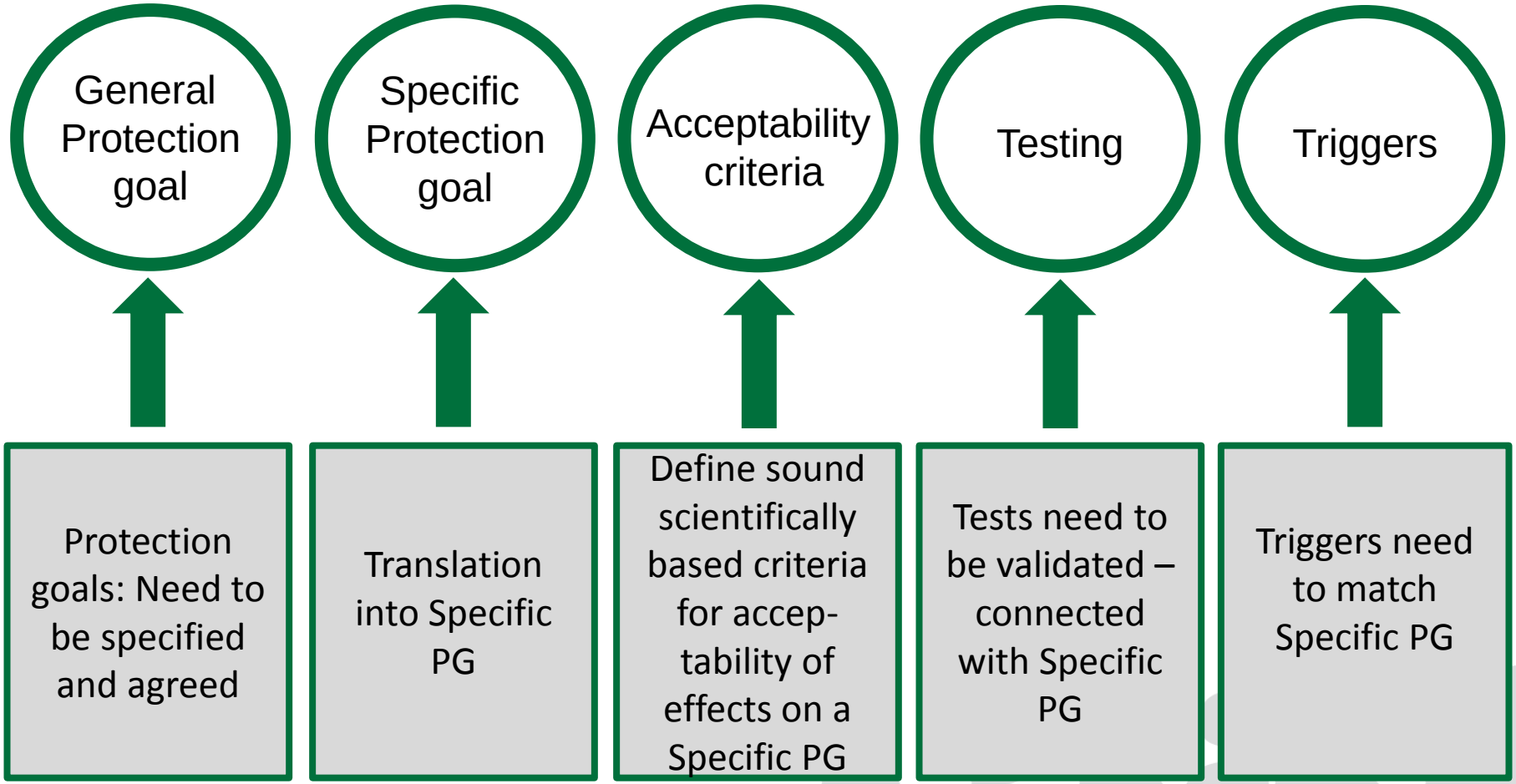


**Testing and Trigger need to match realistic protection goals**

# Ecosystem services

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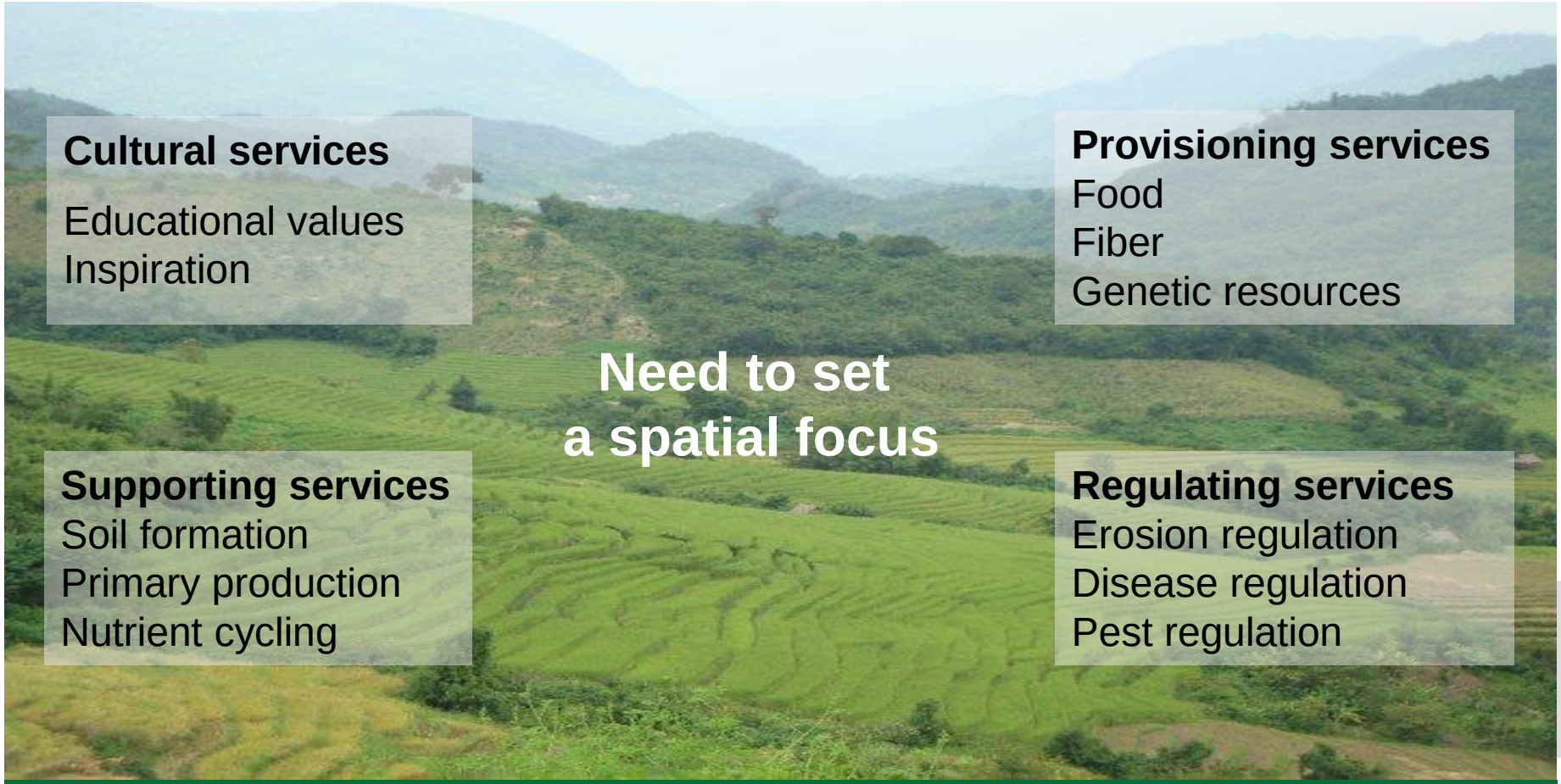
- **Heterogenous ecosystems**




**Different EsS provided by different land uses**

# Specific protection goals

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Different specific protection goals in-field & off-field

- Important ecosystem services for sustainable agricultural production need to be protected

→ Maintenance of soil fertility

-nutrient cycling

-soil structure

-erosion protection

Focus: in-field

- Different specific protection goals for biodiversity based on the land use

**Can’t protect everything everywhere all the time**

# How to protect ecosystem services

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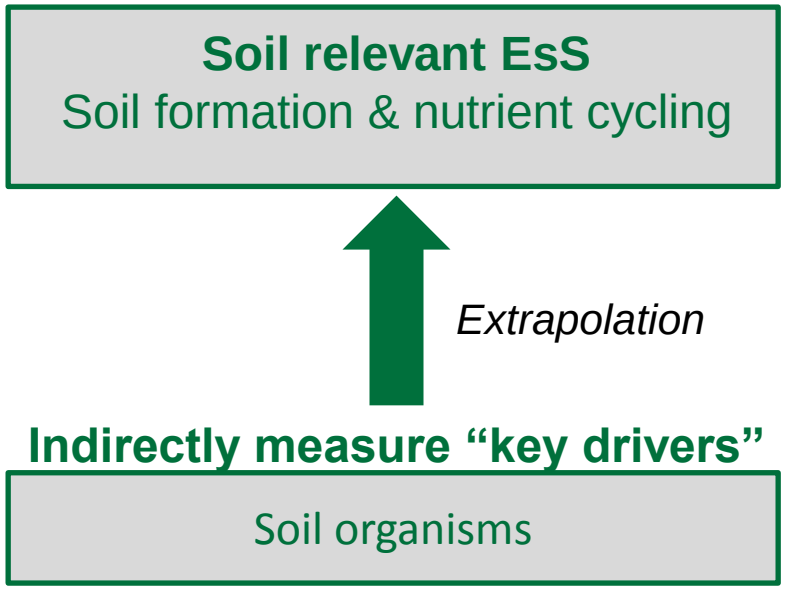
- Directly measure ecosystem services
- Reduce uncertainty in risk assessments

**Measure parameter which are directly linked to EsS**



# Novel testing methodologies
## -ECPA project-

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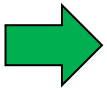
- Alternative functional soil tests are explored

  → direct linked to EsS which we want to protect

- Functional relevance of effects on structure?

Literature search



Field trial

| Test system | Relevance for ESS | Standardization |
|---|---|---|
| **C- & N- transformation** | +++ (nutrient cycling) | +++ |
| **Litterbag** | +++ (organic matter degradation, nutrient cycling) | +++ |
| **Minicontainer** | +++ (organic matter degradation, nutrient cycling) | - |
| **Bait lamina** | ++ | + |
| **Soil micro-arthropods** | ?? | + |

# Novel testing methodologies
## -ECPA project-

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### Field trial: 2015 – 2016

- Control
- Methamidophos: 600 g a.s./ha
- Methamidophos: 3000 g a.s./ha
- Lindane: 2.5 kg a.s./ha
- Lindane: 7.5 kg a.s./ha

- Litterbag test
- Minicontainer test
- Bait lamina test
- Soil micro-arthropods

**The Minicontainer test can represent a suitable alternative functional test system**

# How to protect biodiversity → Landscape level

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## Different specific protection goals for biodiversity in-field & off-field

→ Differentiation in …

- Taxonomical resolution, ecological/functional relevance (e.g. functional groups vs species/community)
- Temporal dimension (acceptable recovery times)

| | In-field | Off-field |
|---|---|---|
| Protect | Organisms with high functional relevance | Biodiversity |
| Attribute | Functional groups and key drivers | Species & communities |
| Temporal scale | Year | Weeks |

# How to protect biodiversity?

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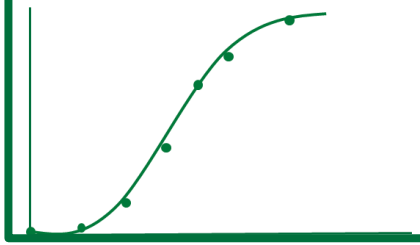

## Tier 1 risk assessment

$$TER = \frac{Toxicity}{Exposure}$$


Options for refinement

## Scenario specific effect modeling

- Identify areas and/or scenarios of low and potential high risk
- Find suitable sites for higher tier testing

## Intermediate tiered testing

- Testing under a more realistic exposure regime
- Natural soil testing
- Studies assessing the potential for recovery

## Risk mitigation

- no-spray buffers
- Use restrictions based on results of scenario specific modeling

## Higher tier studies

- Field effect studies with relevant key drivers

# Conclusions

- Different level of protection depending on land use
- Protect important ecosystem services in-field
- Functional tests allows us to better link risk assessment with protection goals derived from EsS
- Protection of biodiversity: focus off-field

# More information

- **Poster Dinter: A Comparison of Functional and Structural Soil Testing for Risk Assessment of PPPs**
- **Poster Ernst: Measure soil functions directly related to Ecosystem Services**
- **Poster Bergtold: Protection goals**
- **Poster Coulson: Re-calibration of the earthworm tier 1 risk assessment of plant protection products**

# Thank You

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