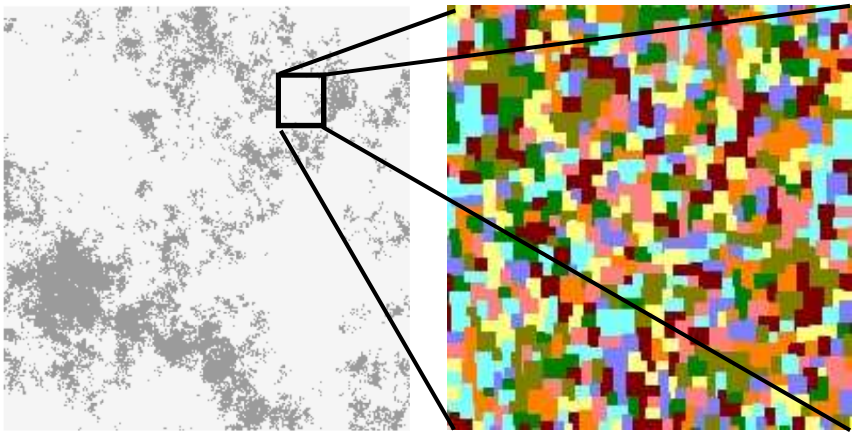
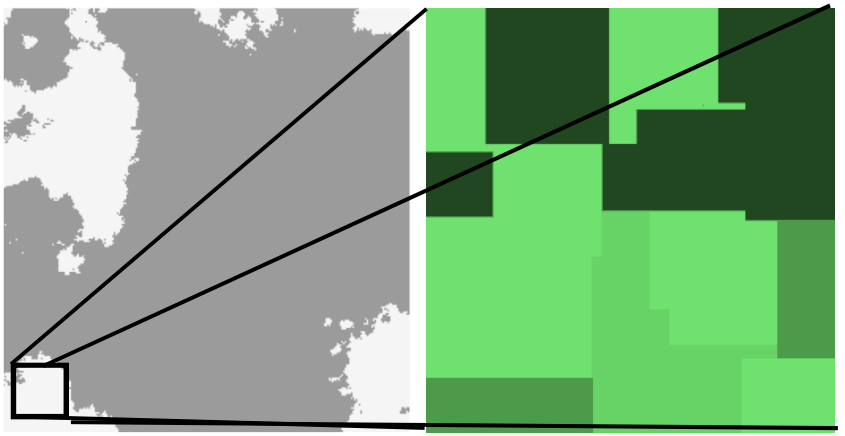
# A landscape generator prototype and its application as tool for integrated regional environmental impact assessment of bioenergy activities

**Sandro Pütz[1,2] , Jeroen Everaars[2], Daniela Thrän[1,3], Karin Frank[2]**





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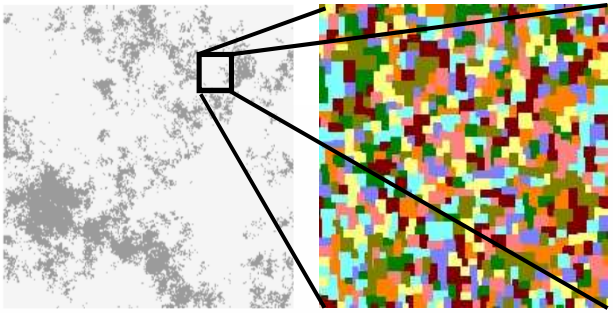
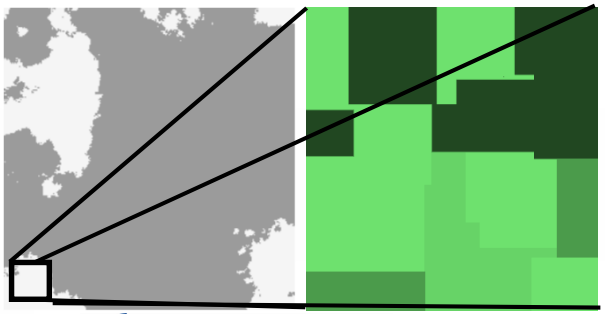
# Introduction

**Aim:**
Sustainable use of crop biomass for Bioenergy at landscape and regional level.

**Need:**
**Basic understanding** how landscape structure influences the environmental impact of bioenergy use of crop biomass.





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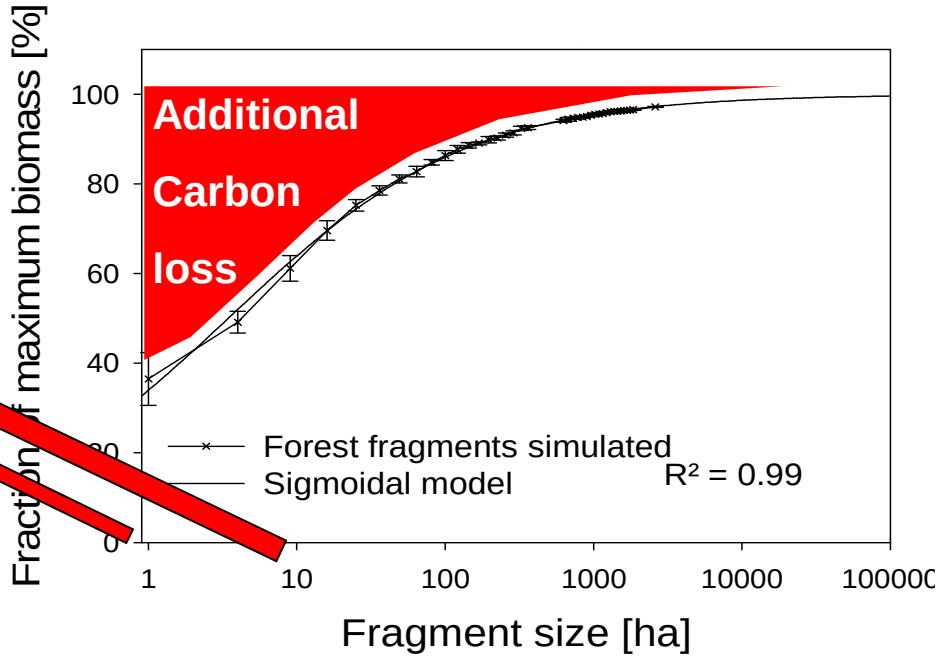
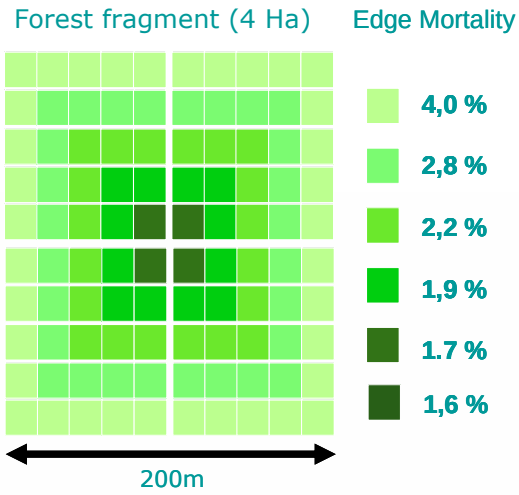
# Introduction:

## Example: Spatial impacts at landscape scale




Conversion of pristine forests has **additional** negative spatial impacts!

Pütz et al. in prep.

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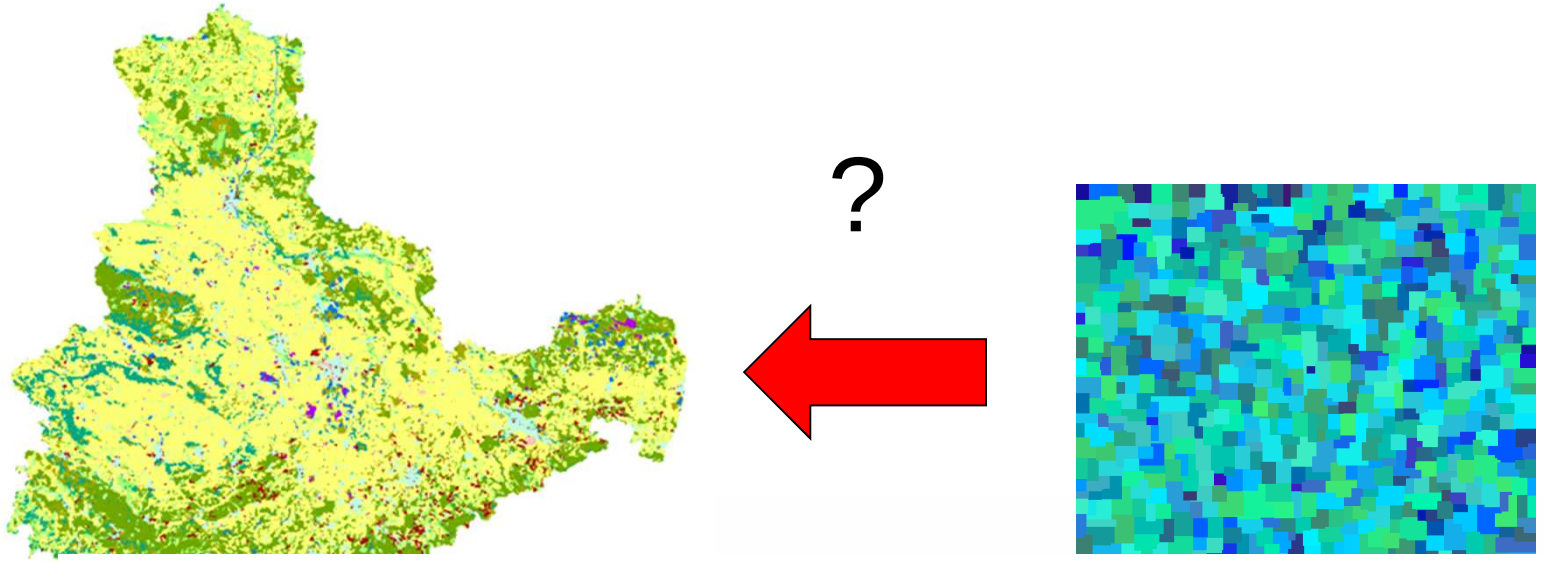
# Introduction

**Problem: many spatial simulation models at different and smaller scales !**



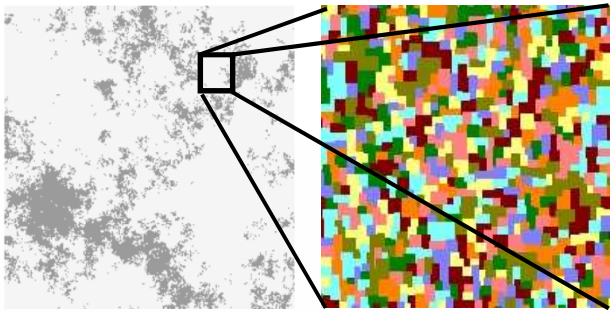

**How to deal with small scall models for regional assessment?**

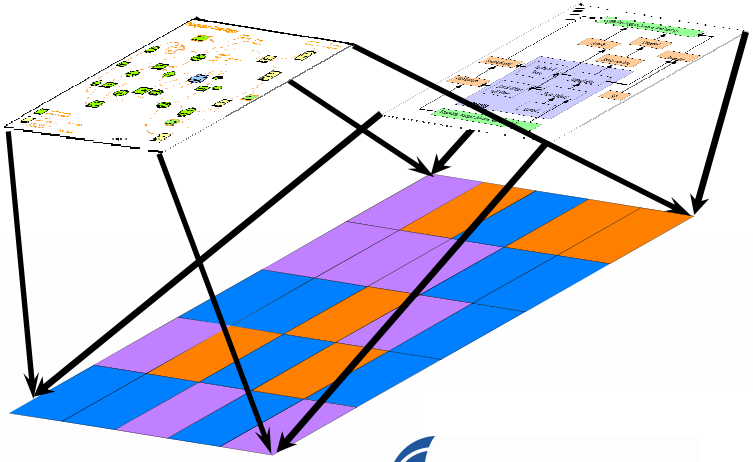
# Introduction

## Research Agenda:

Development of a landscape generator at the landscape scale generating model landscapes.

Model landscapes are designed such, that a consistent, multi-criterial analysis of several environmental impacts is possible.





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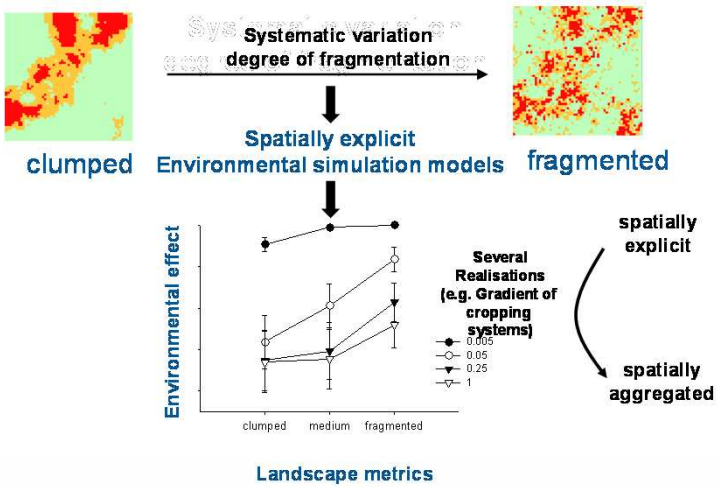
# Introduction

## Research Agenda:

Aggregation of spatial ecological and environmental effects into the landscape scale - Landscape metrics.




Further development of Life Cycle Assessments (spLCAs):
Inclusion of space and Biodiversity.

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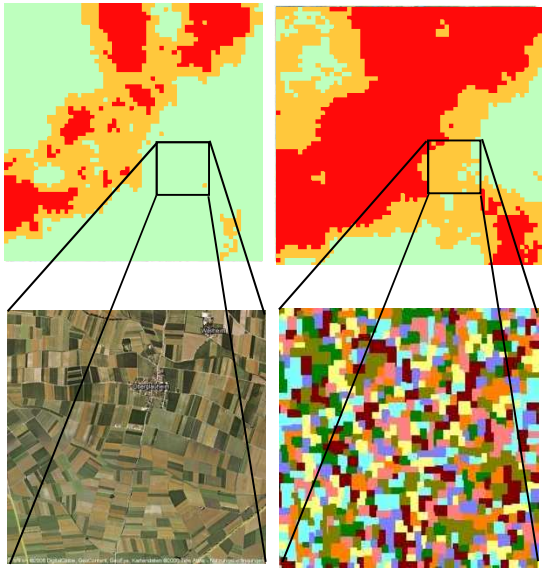
# Approach

## Scenario based, systematic parameter variation

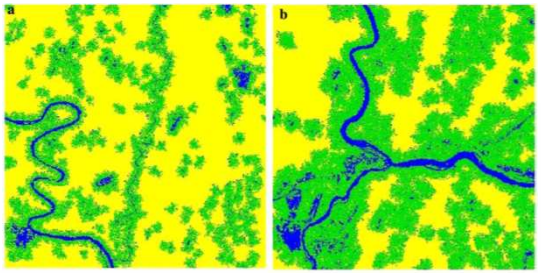
**Gradients**

Natural landscape unit
forest cover, fragmentation



Integration of land use
patterns (cropping systems)

Integration of gradients,
rivers and streams



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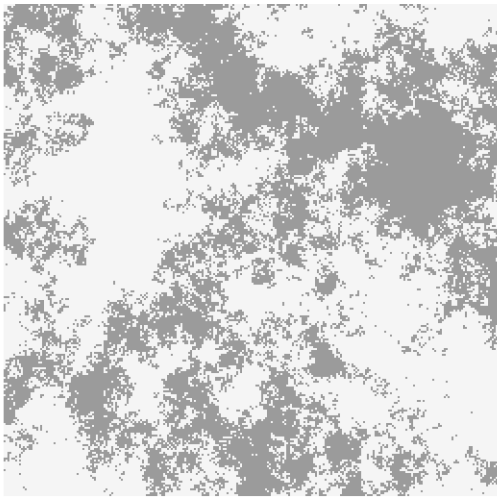
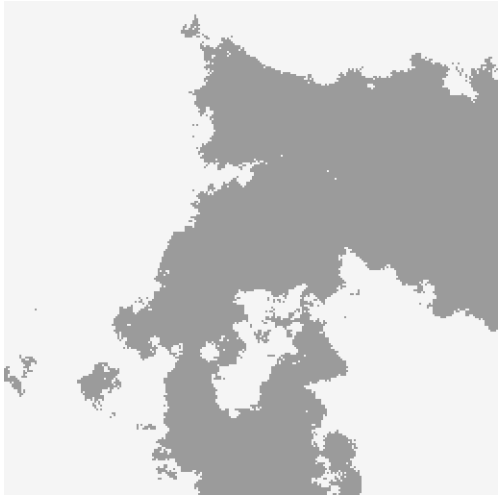
# Approach:

## Large scale spatial patterns:





Variation of:

- % of forest cover and agricultural area
- Degree of forest fragmentation

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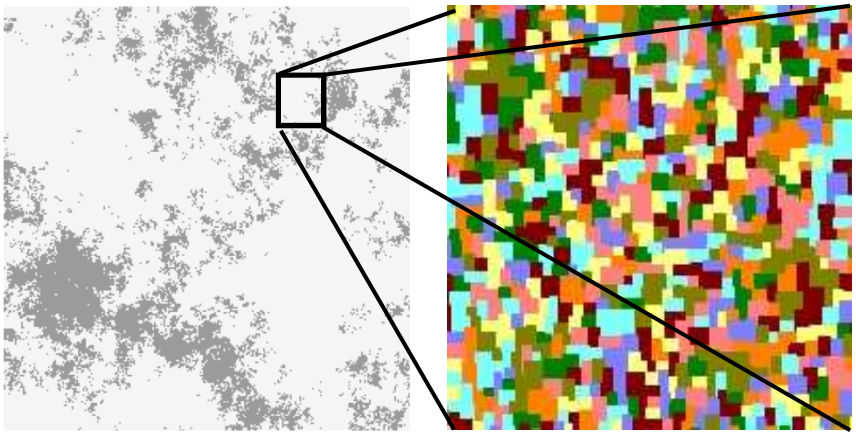
# Approach

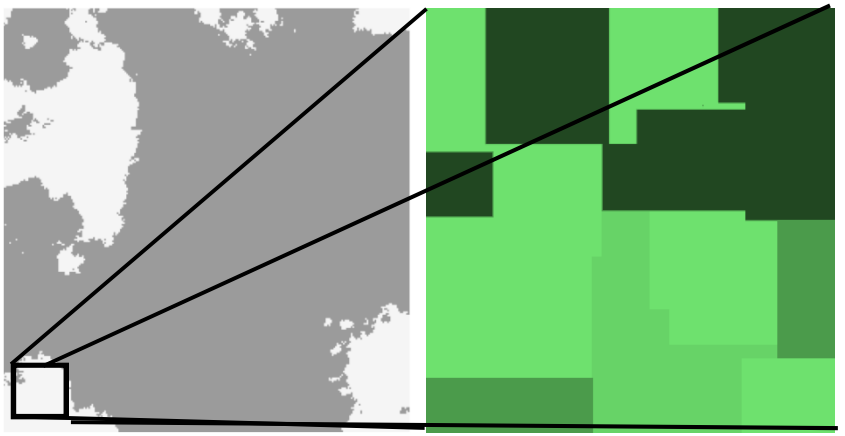
Systematic evaluation of Model landscapes

## Distribution of cropping systems within large scale spatial pattern.



Crop diversity

Cropping systems (management)



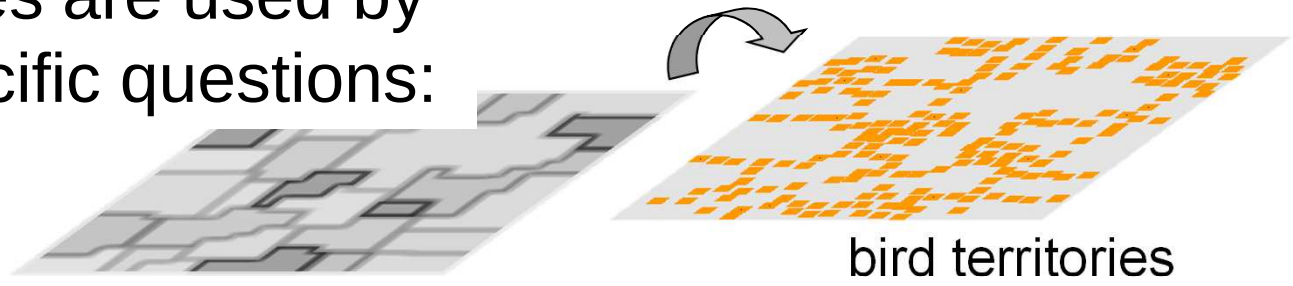
Size of agricultural fields

Spatial distribution of fields

# Analysis:

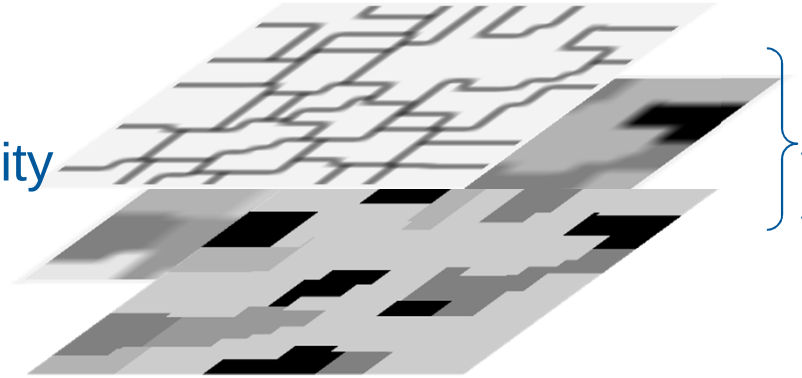
## Systematic evaluation of Model landscapes

Model landscapes are used by models with specific questions:



overall suitability

bird territories



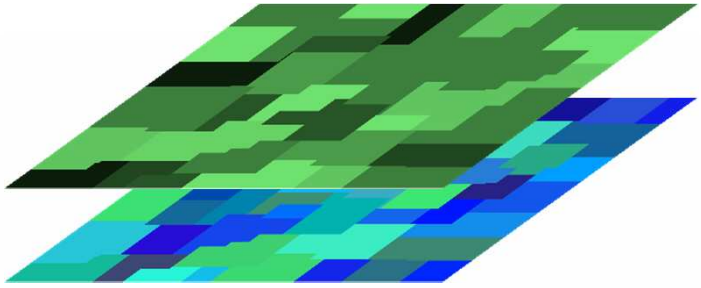
3.crop diversity

2.feeding

1.nesting

bird species specific

INPUT from Landscape Generator!



cropping scenarios

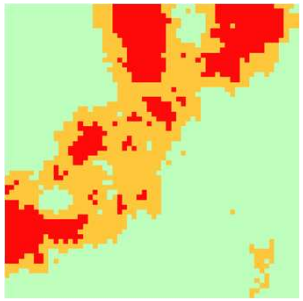
agricultural fields

3 km

Source: Jeroen Everaars

# Landscape metrics:

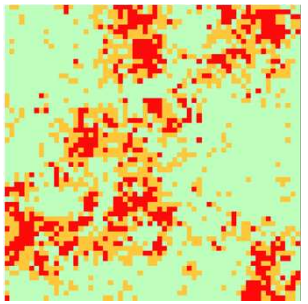
## Identification of Landscape metrics as Indicators



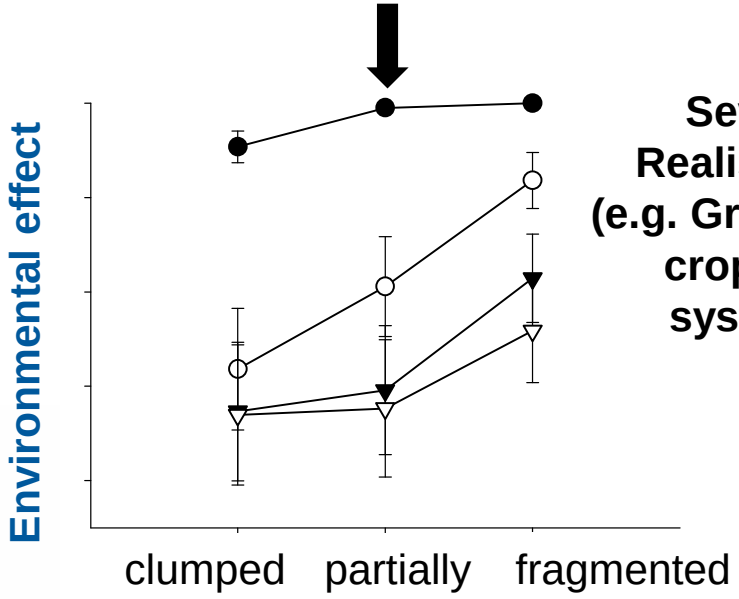
clumped

**Systematic variation**
**degree of fragmentation**

**Spatially explicit**
**Environmental simulation models**



fragmented




**Several Realisations (e.g. Gradient of cropping systems)**

**spatially explicit**

**spatially aggregated**

**Landscape metrics**

Source: Thulke et al.

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# Landscape generators as „tool for cooperation“

**POF based projects about spatial ecological impacts of biomass use: They use the output of the landscape generator**

| Dispersion & persistence: Birds, Butterflies | Biomass estimates, CO2-Balance: Plant systems | Functional connectivity: crucial for biodiversity, several taxa |
|---|---|---|

- Understanding of spatial effects
- Landscape metrics as indicators
- **Interpretation -> Biomass cultivation**

**Input for spatially explicit Life cycle assessment (spLCA) of Bioenergy Systems analysis group**

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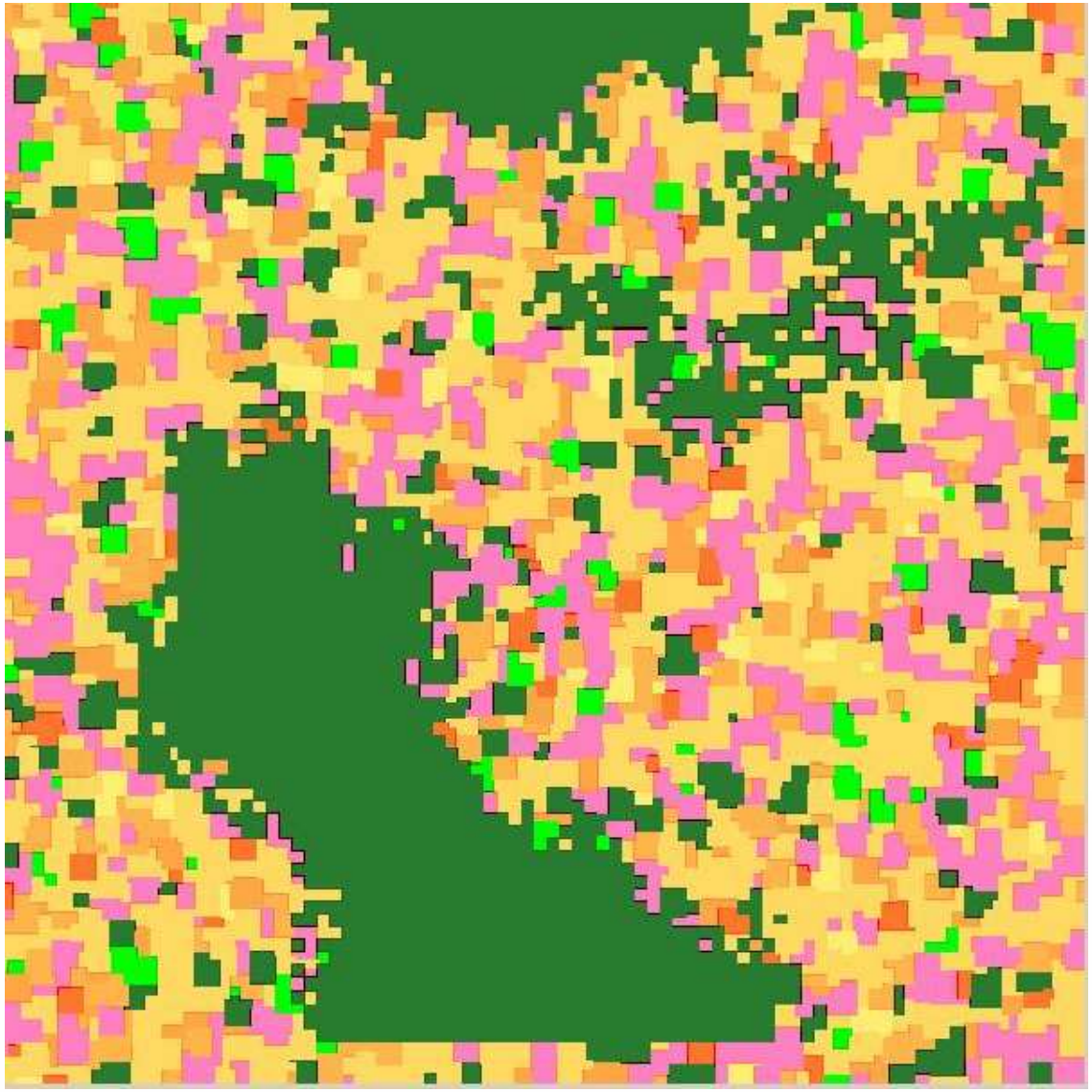
# „Result“: Landscape generator prototype



## Example First version

- Forest, connected
- Small fields of diff. crops

## Next steps:

- Inclusion of field strips
- Scaling issues
- Field distributions

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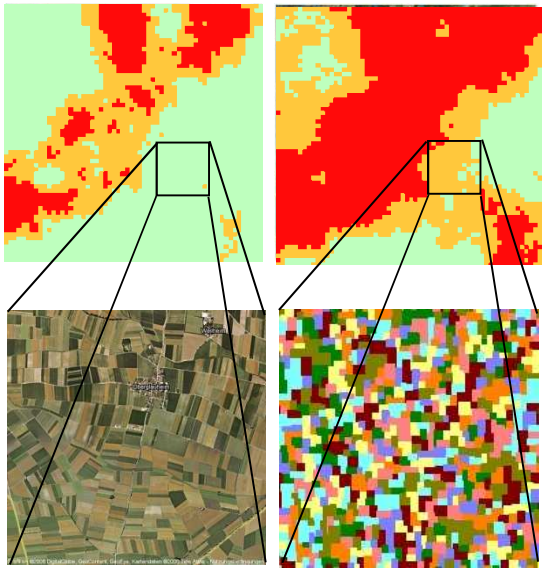
# Summary

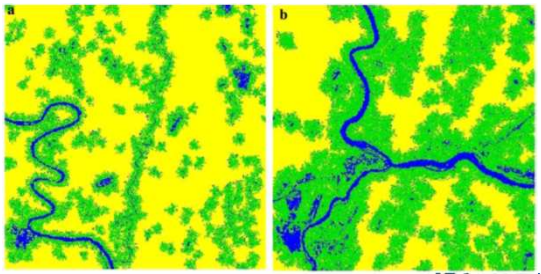
## Landscape generator for inclusion of small scale models into Landscape and regional impact assessment

Natural landscape unit
forest cover, fragmentation

Integration of land use
patterns (cropping systems)



Integration of gradients,
rivers and streams



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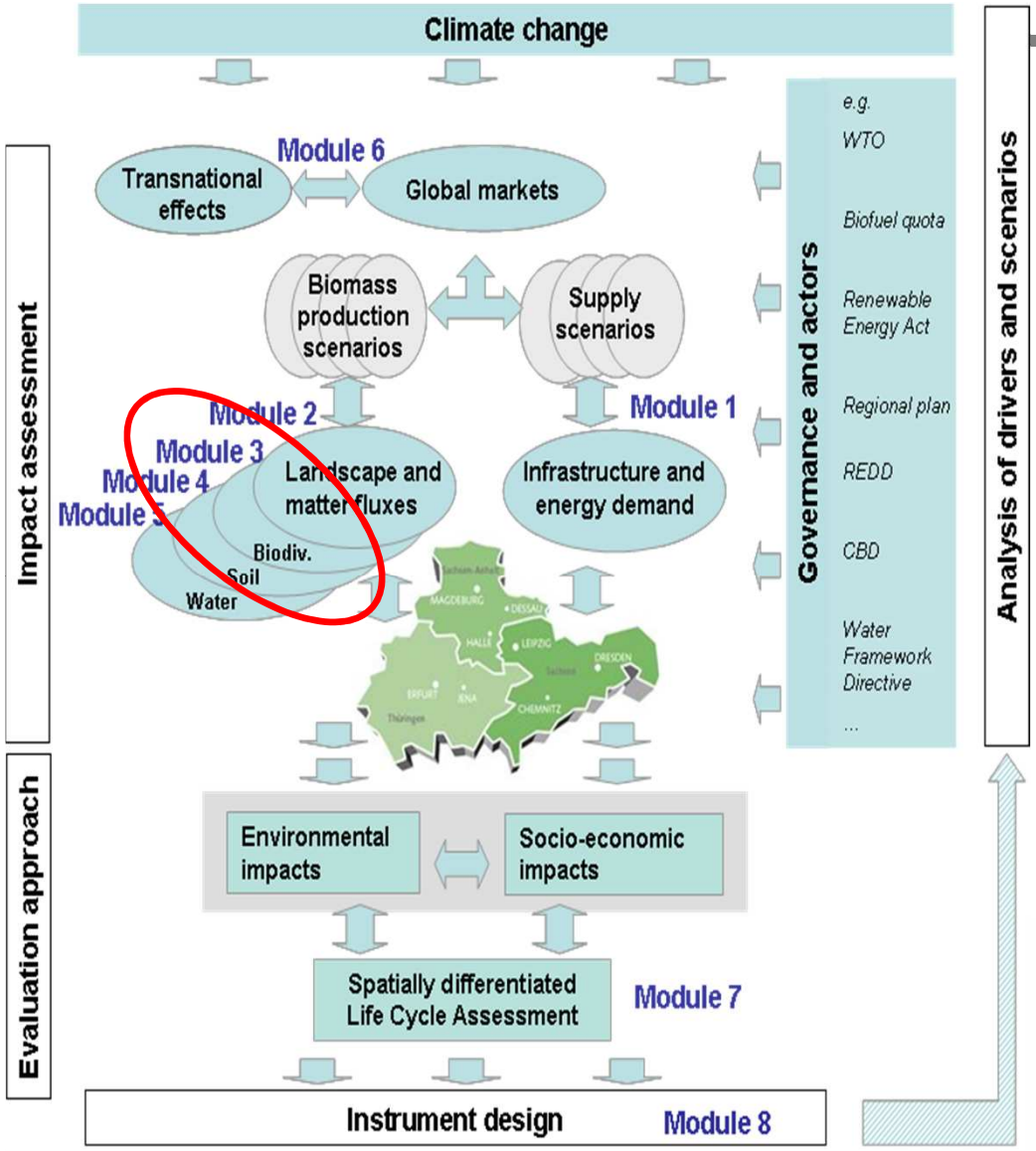


# Thank you for your attention !

**And Jeroen Everaars and Jan Engel for providing former versions.**

**Questions?**

**Contact:**

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