



# Sustainable Land Use and Climate Mitigation: Management Options and Enhanced Knowledge

## Research Findings for Agricultural Land Use in Germany

Johanna Fick<sup>1</sup>, Sarah Baum<sup>1</sup>, Rene Dechow<sup>2</sup>, Peter Kreins<sup>1</sup>, Martin Henseler<sup>1,3</sup>, Jesko Hirschfeld<sup>4</sup>, Julian Sagebiel<sup>4</sup>

<sup>1</sup>) *Thünen Institute of Rural Studies, Federal Institute for Rural Area, Forestry and Fisheries, Braunschweig*

<sup>2</sup>) *Thünen Institute of Climate-Smart Agriculture, Federal Institute for Rural Area, Forestry and Fisheries, Braunschweig*

<sup>3</sup>) *EDEHN - Equipe d'Economie Le Havre Normandie, Université du Havre,*

<sup>4</sup>) *Institute for Ecological Economy Research (IÖW)*



- Land use in Germany and the additional challenge: Climate Change
- Research approach
- Selected Results: climate mitigation by agricultural land use
- Summary



## Settlement and Transport

- Residence
- Recreation
- Mobility

## Agriculture

- Food
- Feedstuff
- Bioenergy

## Forestry

- Wood
- Bioenergy

## Nature Conservation

primary on agricultural and forest areas

- Ecological services

Climate Change: Land use responsible for circa 10% of greenhouse gas emissions in Germany

National GHG policy: Overall goal -40% by 2020 (ref. 1990) / Achieved: -24% in 2013 (constant since 2008)

High GHG emissions of agricultural soil management, land use and land use change (2012):

- Agricultural soils (4.4%) and LULUCF (4.6%):
- 9% of Germany's total GHG emissions; 12% incl. livestock farming

## Greenhouse gas emissions of agricultural land use in Germany (excl. livestock)



Organic soils  
**49.2%**



Fertilizer application  
**17.0%**



Leaching  
**13.8%**



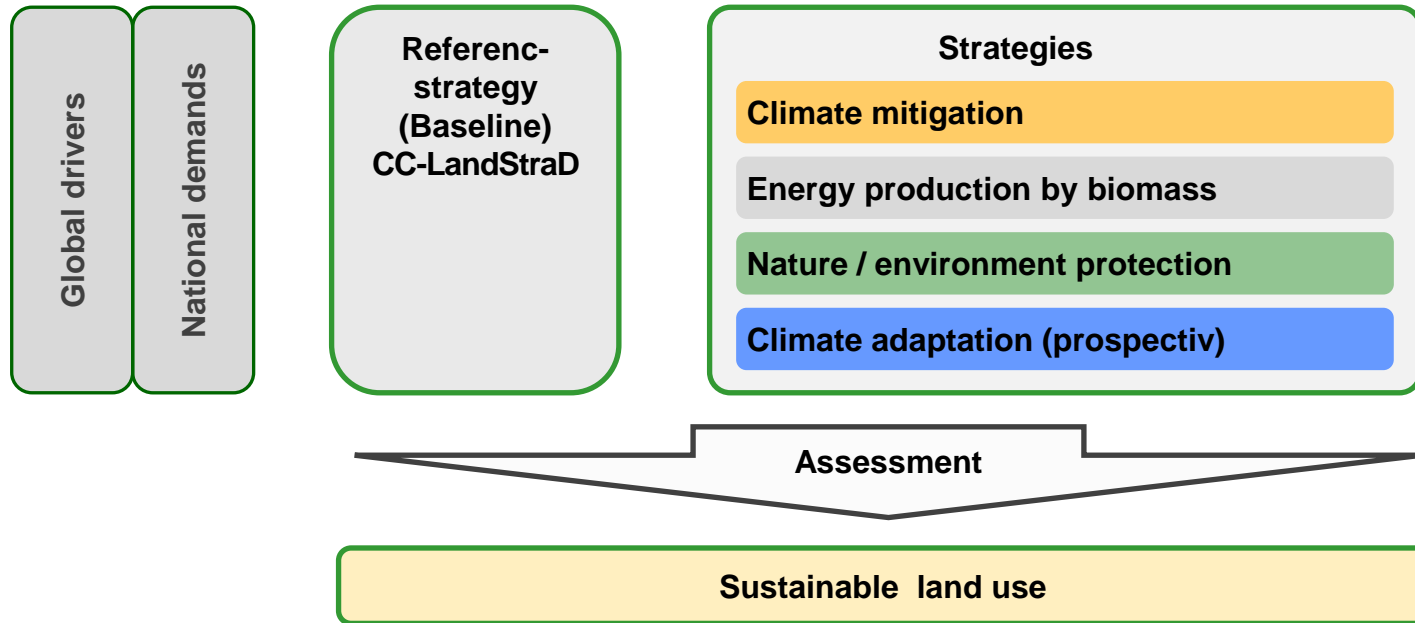
Grassland (min. soils)  
to arable land  
**4.5%**

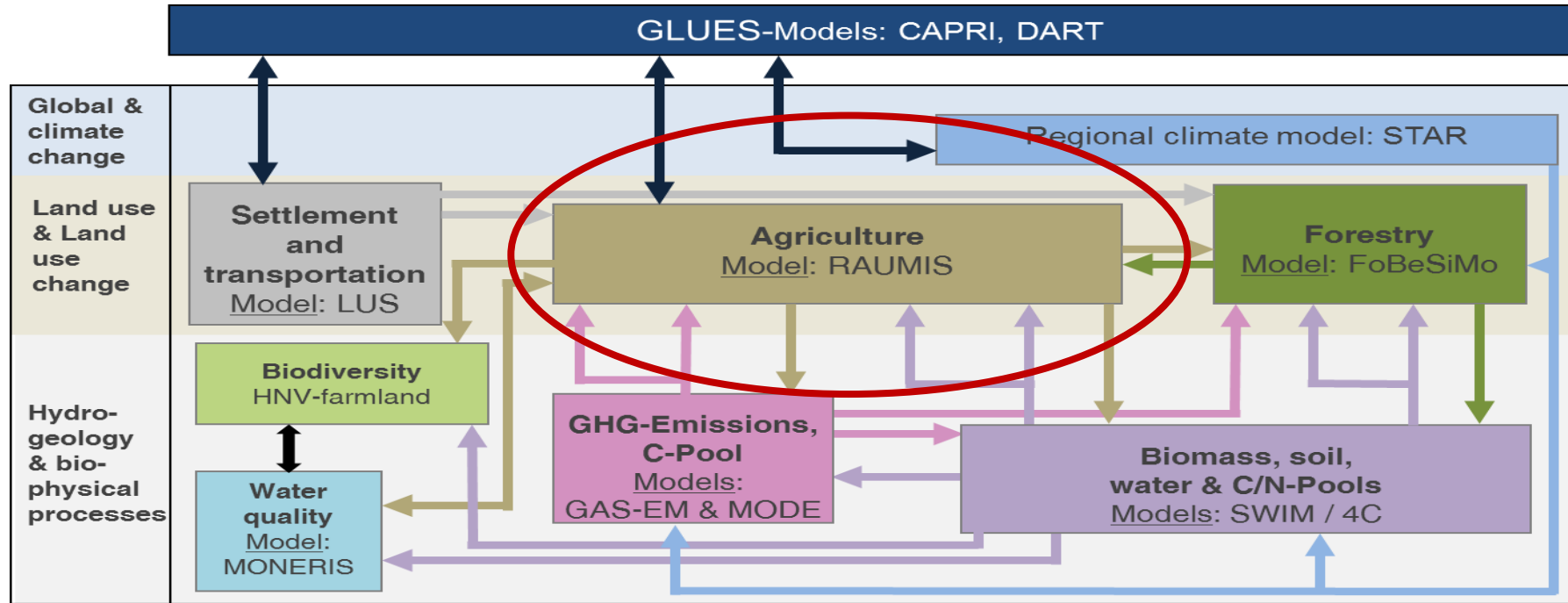


Other sources  
**15.6%**

Source: Sarah Baum after NIR (2014)

# The conceptual design of strategies considers global drivers and national demands





Measure	Policy instruments	Climate mitigation
Afforestation	Order of afforestation	+10% forest
Rewetting of organic soils	Mitigation payment; max. 30% of peatland	100 € / t CO <sub>2</sub> -equ.*
Reduction of land use intensity	Nitrogen tax on mineral fertilizer	+40% on reference price in 2030

\*Schwermer S, Preiss P, Müller W (2012): Best-Practice-Kostensätze für Luftschadstoffe, Verkehr, Strom- und Wärmeerzeugung, Anhang B der „Methodenkonvention 2.0 zur Schätzung von Umweltkosten“

			Reference 2030	Climate mitigation compared with reference
Indicators			Mio.	%
<b>Agricultural sector</b>	Income inclusive mitigation payment	EUR	26,000	-4.4
	Food production	t GE	300	-5.5
	Bioenergy production	MJ	49,000	-4.7
	Net GHG emission	t CO <sub>2</sub> -equ.	73	-16.3
	Mitigation effect	t CO <sub>2</sub> -equ.	9	63.3
	Total nitrogen balance	t N	1	-6.4

## Additional effects:

- Carbon storage by reforestration
- savings from reduced mineral fertilizer production
- Effects by indirect land use changes



- Rewetting of organic soils: very high potential for reducing GHG emissions at comparably little requirement for land; high regionally effect
- Measures enhancing efficiency of mineral and organic fertilizers important
- Retirement of land from agricultural production (afforestation, set-aside)
- Location dependent combinations of measures → consideration of regional factors necessary
- Reduction of production and iLUC have to be considered as well as effects on GHG emissions of other sectors

# Thank you for your attention!

## Further information: [www.cc-landstrad.de](http://www.cc-landstrad.de)

Hoymann, Jana; Goetzke, Roland (2016) Simulation and Evaluation of Urban Growth for Germany Including Climate Change Mitigation and Adaptation Measures. ISPRS Int. J. Geo-Inf. 2016, 5(7), 101.

Henseler, Martin; Röder, Norbert; Liebersbach, Horst; Kreins, Peter; Osterburg, Bernhard (2015): Mitigation potential and cost efficiency of abatement based subsidies for production of short rotation coppices in Germany. Biomass and Bioenergy 81:592-601. Oktober 2015.

Röder, Norbert; Henseler, Martin; Liebersbach, Horst; Kreins, Peter; Osterburg, Bernhard (2015): Evaluation of land use based greenhouse gas abatement measures in Germany. Ecological Economics, 117, 193-202.

Steinhäuser, Reimund, Siebert, Rosemarie, Steinführer, Annett, Hellmich, Meike (2015): National and regional land-use conflicts in Germany from the perspective of stakeholders. Land Use Policy 49, 183-194.

Meyerhoff, Jürgen; Oehlmann, Malte; Weller, Priska (2015): The Influence of Design Dimensions on Stated Choices in an Environmental Context. Environmental and Resource Economics 61 (3). 385-407.

Weller, Priska; Oehlmann, Malte; Mariel, Petr; Meyerhoff, Jürgen (2014): Stated and inferred attribute non-attendance in a design of designs approach. Journal of Choice Modelling (11). 43-56.

Leppelt, Thomas et al. (2014): Nitrous oxide emission budgets and land-use-driven hotspots for organic soils in Europe Biogeosciences, 11(23), 6595-6612.

Hoymann, Jana; Goetzke, Roland (2014): Die Zukunft der Landnutzung in Deutschland – Darstellung eines methodischen Frameworks. Raumforschung & Raumordnung 72 (3), 211–225.

Goetzke, Roland; Hoymann, Jana (2014): Flächeninanspruchnahme in Deutschland bis 2030 - Auswirkungen auf den Boden. Bodenschutz (3), 83–88.