I N T E G R A T E D S I N K E N H A N C E M E N T A S S E S S M E N T

I N S E A
P A R T N E R S

Cost and GHG-Emission Landscape in Agriculture

-Policy Scenarios and their Influence on Farm Structure -

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Structure

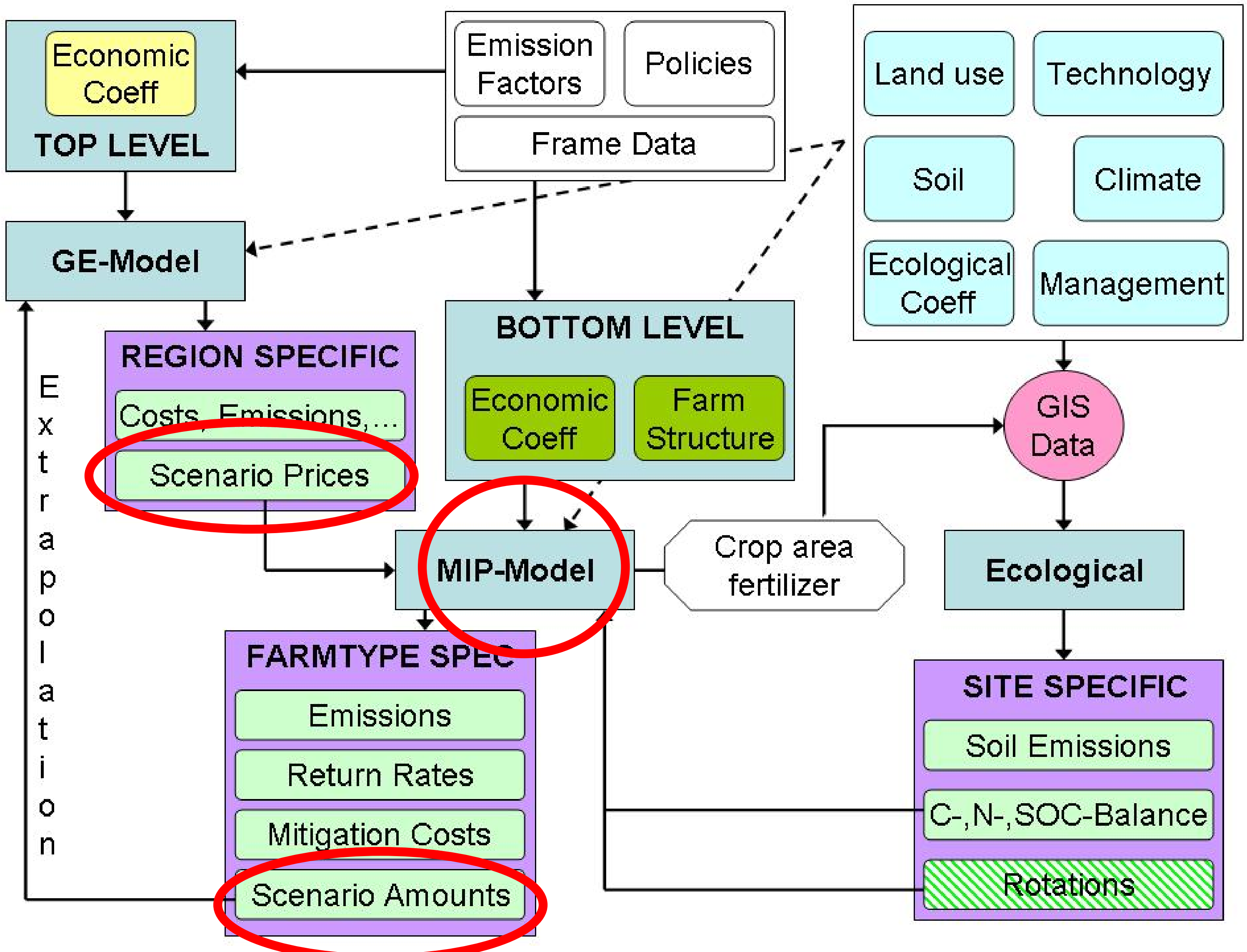
1. Model: EFEM Introduction
2. Data: Preparation and Needs
3. Production Costs
4. Management Options
5. Reference Situation
6. Scenarios: Assumptions and Results
7. Outlook

Introduction

- Economic-Ecological Farm-level Model: max. GM
- Hierarchically coupled with ecological model
- Various GHG-accounting methods integrated
- Regional resolution: NUTS-II
  - Intersection of FADN with NUTS regions (Combinations of Codes `a1-a2` fitted into, except for Portugal)
- ´Typical farms`: not FADN average, but modified

Differences in Arable Farm in DE11											
	milkquota	arable_ar	grass_ar	cattle	pigs	sheep	opoultry	lu24	lu25	lu26	lu28
Modified	4,222	43,622	0,000	0,000	0,000	0,000	27,836	0,842	1,554	0,179	0,119
Original	4,222	43,622	4,018	3,718	4,557	0,013	27,836	0,842	1,554	0,179	0,119
	lu30	lu40	lu43	lu44	lu45	lu46	lu47	lu48	lu49	potato	sbeet
Modified	1,025	0,013	0,255	0,956	3,326	0,020	0,009	0,040	27,83	1,160	2,368
Original	1,025	0,013	0,255	0,956	3,326	0,020	0,009	0,040	27,83	1,160	2,368

INSEA Data Flow

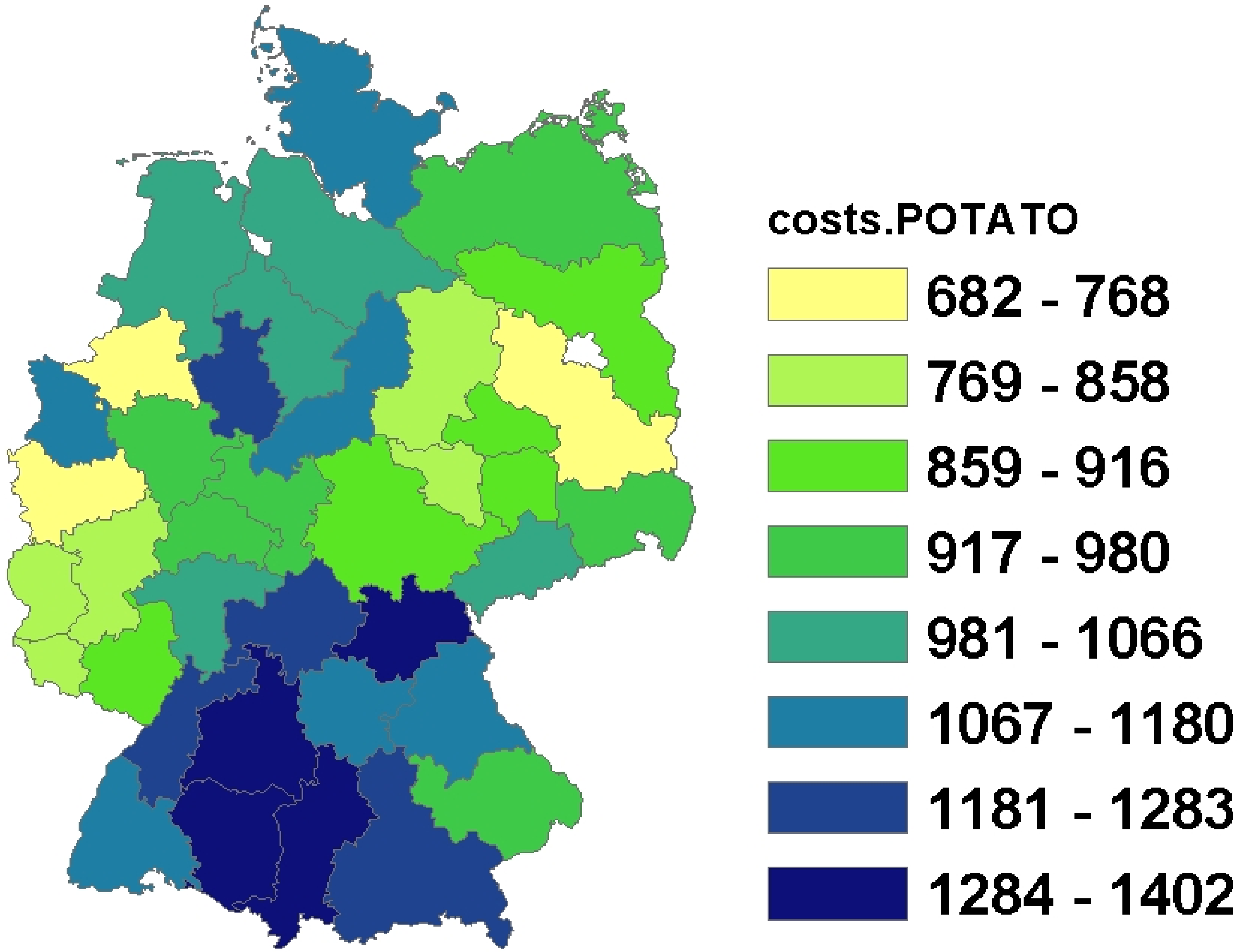


Data Preparation

- Animal Categories to single animal types
  - Intersection of NewCronos with FADN data
- Data Gap for Forage Grown on Arable
  - German Data base: share transferred to NC
- Quota endowment verified
- National sales prices
- Production Costs
  - Animals: German national data
  - Plants: Acc. to FADN and national engineering cost data

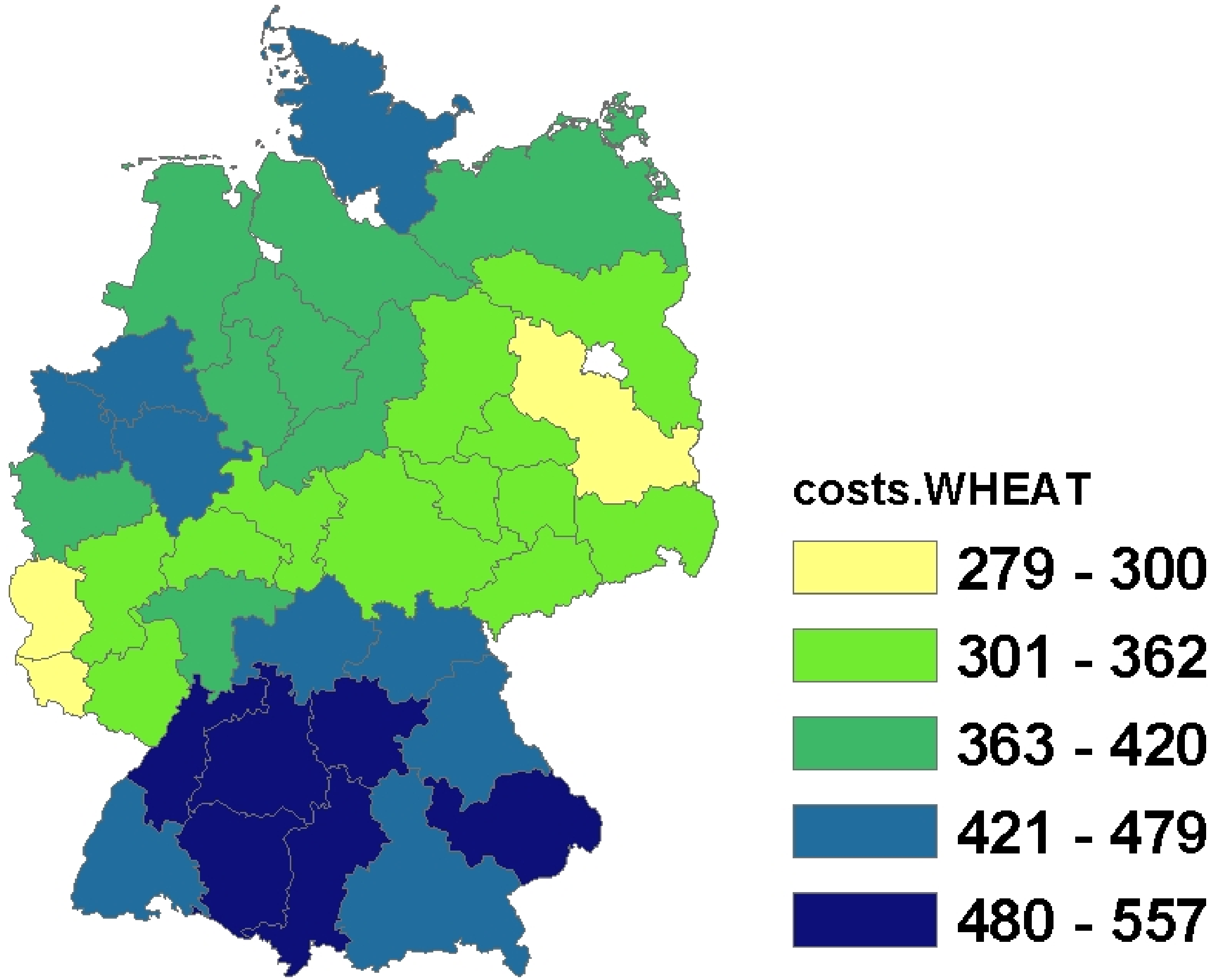
Production Costs Germany: Ex-1

Fertilizer expenditures excluded



Production Costs Germany: Ex-2

Fertilizer expenditures excluded



Alternative Management Options

- Conservation tillage: reduced and no-till

Ecological: yield, erosion, carbon pool
Economic: yield, inputs, labour

- Other technical measures: e.g. slurry injection

Ecological: emissions, nutrient loss
Economic: labour, other costs

- Bio-energy: fermentation
  - to methane: plant material and manure
  - to alcohol: sugars and starch

Ecological: nutrient loss and availability
Economic: alternative production method

Tillage: Carbon Level

EPIC-CR

- only local not global
- soil characteristics

Few but very specific:

CR(*hrucode, elevation, slope, DTR, soiltype***)**

Homogenous:

comparison of regions (climate, soil) and crop shares (grouped)

Interpretation

- **Loss of information**
- **Gain in options**

Germany:

60 rotations; several per region

Integration into EFEM

Tillage: Crop Rotations

OC-Change (%) for stratified EPIC-rotations

					conv	redu	mini
Rot34	Elv1	Slp1	Soil1	Dtr1	-.19	.10	.15
Rot34	Elv1	Slp1	Soil5	Dtr1	.01	.01	.02
Rot34	Elv1	Slp1	Soil6	Dtr1	-.05	.02	.03
Rot37	Elv1	Slp1	Soil3	Dtr1	.08	.04	.08
Rot37	Elv1	Slp1	Soil5	Dtr1	.02	.02	.06

Direction of effects seems reasonable, but interpretation difficult

Tillage: Costs of Alternatives

Change of Default Number of Trips by:	Reduced		Minimum	
	G1	G2	G1	G2
Plough	-1	-1	-1	-1
Sowing Machine	-1		-1	-1
Field tiller			-2	-1
Chisel plough	+1	+1		
Rotary Harrow		+1		
Comb rotary harrow	-2	-2	-2	-2
Comb driller	+1			
Spraying			+2	+2
Direct Sowing			+1	+1
Harvest Chopper			+1	+1

G1: cereals and oilseeds G2: root crops and maize

In G1 from 15€ to 32€ and in G2 from 6€ to 12€ of varibale costs.

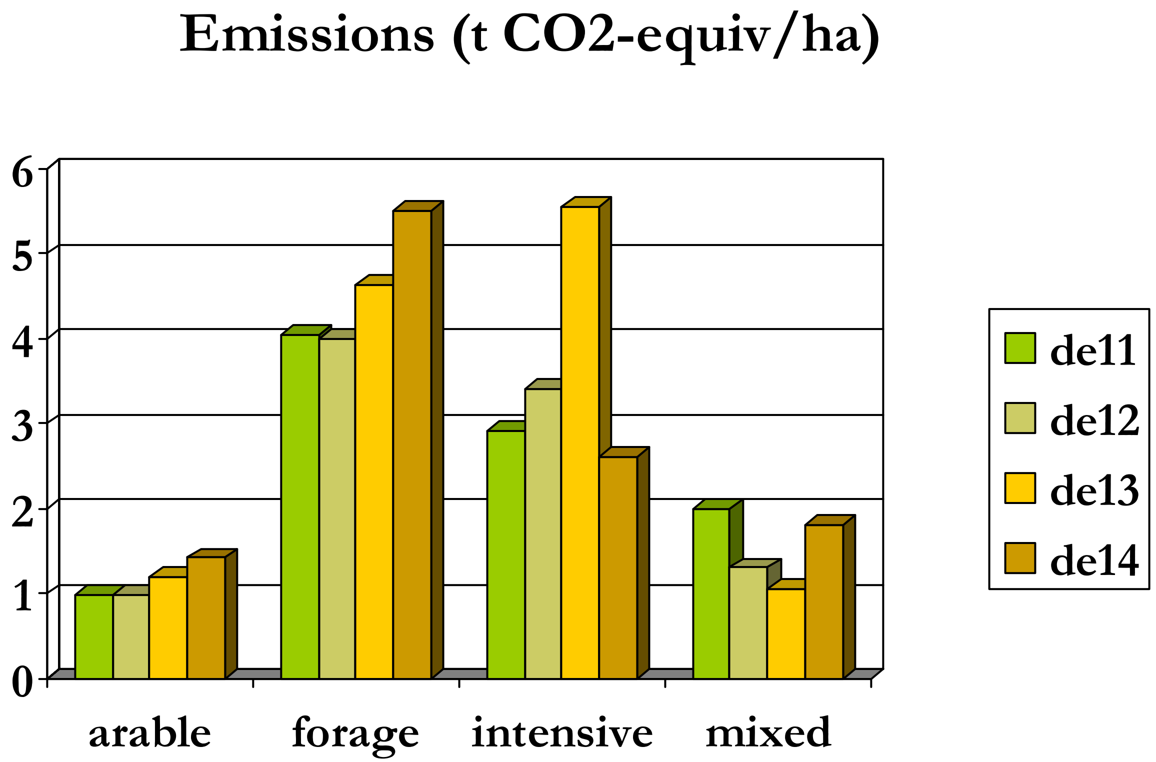
Bio-Energy: Biogas

Source: KTBL (2004), FNR (2006), Top Agrar (2003)

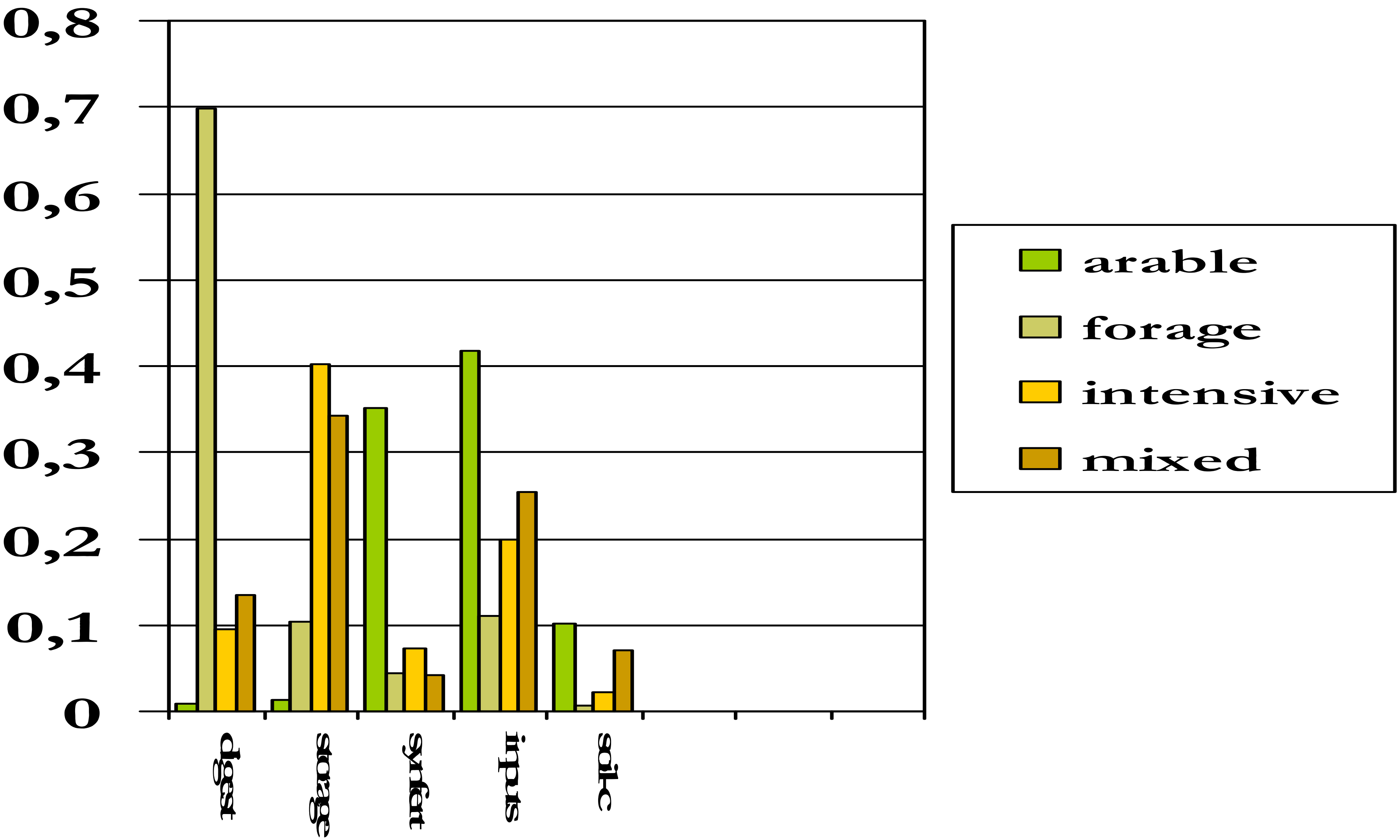
Silage Maize (simplified)	**Value**	**Unit**
Yield methane	185	m^3/t FM
Biogas Methane Content	52.2	%
Efficiency Rate	32.0	%
Base Remuneration	10.1	Ct/kWh
Renewables premium	6.0	Ct/kWh
Revenue	49.7	€/t FM
Variable Costs	1.5	Ct/kWh
Wage	1.9	€/t FM
Storage Costs	4.8	€/t FM
Transport of substrate	25.0	Ct/(t FM*km)
Transport of residues	*98.0*	Ct/(m^3*km)
Variable Costs	13.8	€/t FM
Gross Margin	35.9	€/t FM

Reference

- No conservation tillage
- No bio-energy



Emission Source Specific



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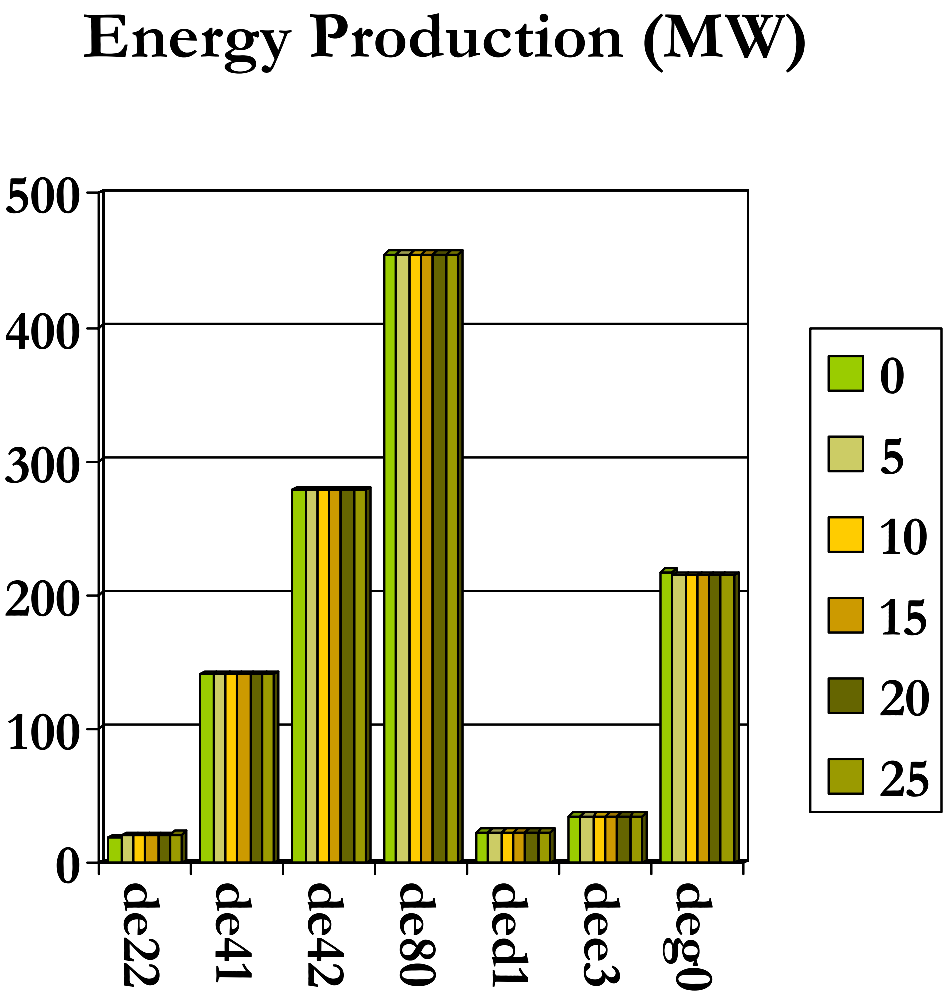
Biogas Production



Produced from slurry and manure. Only in one region from silgae maize.

Scenario: Conservation Tillage

- Comparison of EPIC-carbon values and Cross Compliance

	Tax (€/t)	de11	de12	de13	de14
EPIC	0	0.39	0.51	0.51	0.78
EPIC	5	0.43	0.43	0.57	0.78
EPIC	10	0.50	0.47	0.51	0.78
CrCp	0	0.81	0.96	1.00	1.00
CrCp	5	0.81	0.96	1.00	1.00
CrCp	10	0.81	0.96	1.00	1.00

Energy Efficiency

- Additionally to capital efficiency
  - GE („Getreideeinheiten“) (barley units)

Emissions per Barley Unit in ´DE11´ ($kg\ CO_2/GE$)			
arable	forage	intensive	Mixed
11.47	94.70	5.28	5.60

Outlook and Conclusions

- EPIC simulations deliver more specific results and leave options (independently modeling: straw treatment and manure application)
- Coupling with macro-economic (EU-FASOM) model for balancing purposes and regional production potentials
- Multiple impacts of management and production alternatives give the point to models (nitrogen availability etc.)