Farm location, access to technology and manure management practices

Insights from a case study on pig production in central Thailand

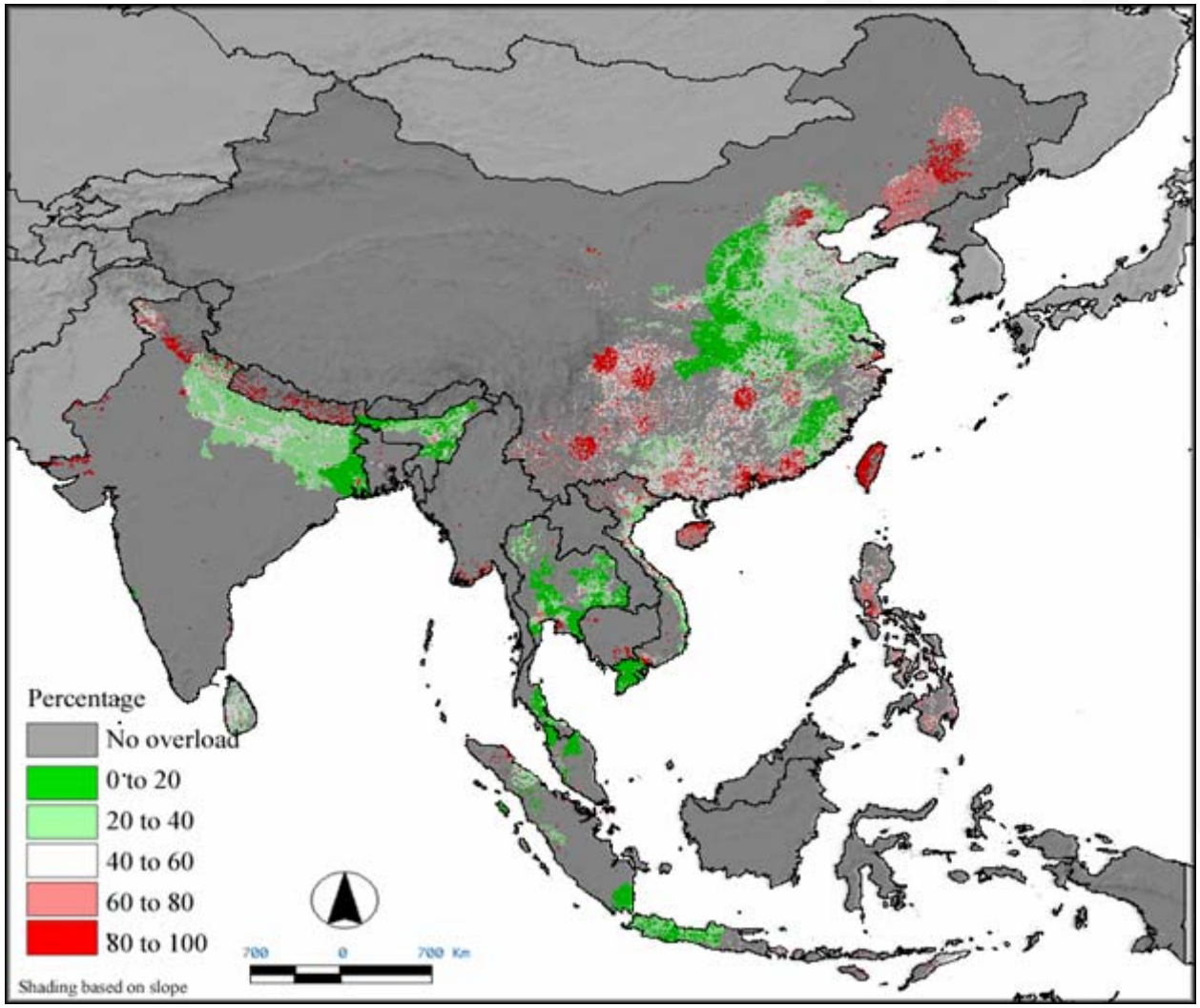
Methane to Markets Partnership Expo

Beijing, China 31 OCTOBER 2007

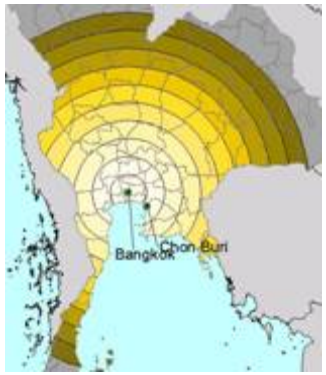
LEAD
Livestock Environment and Development

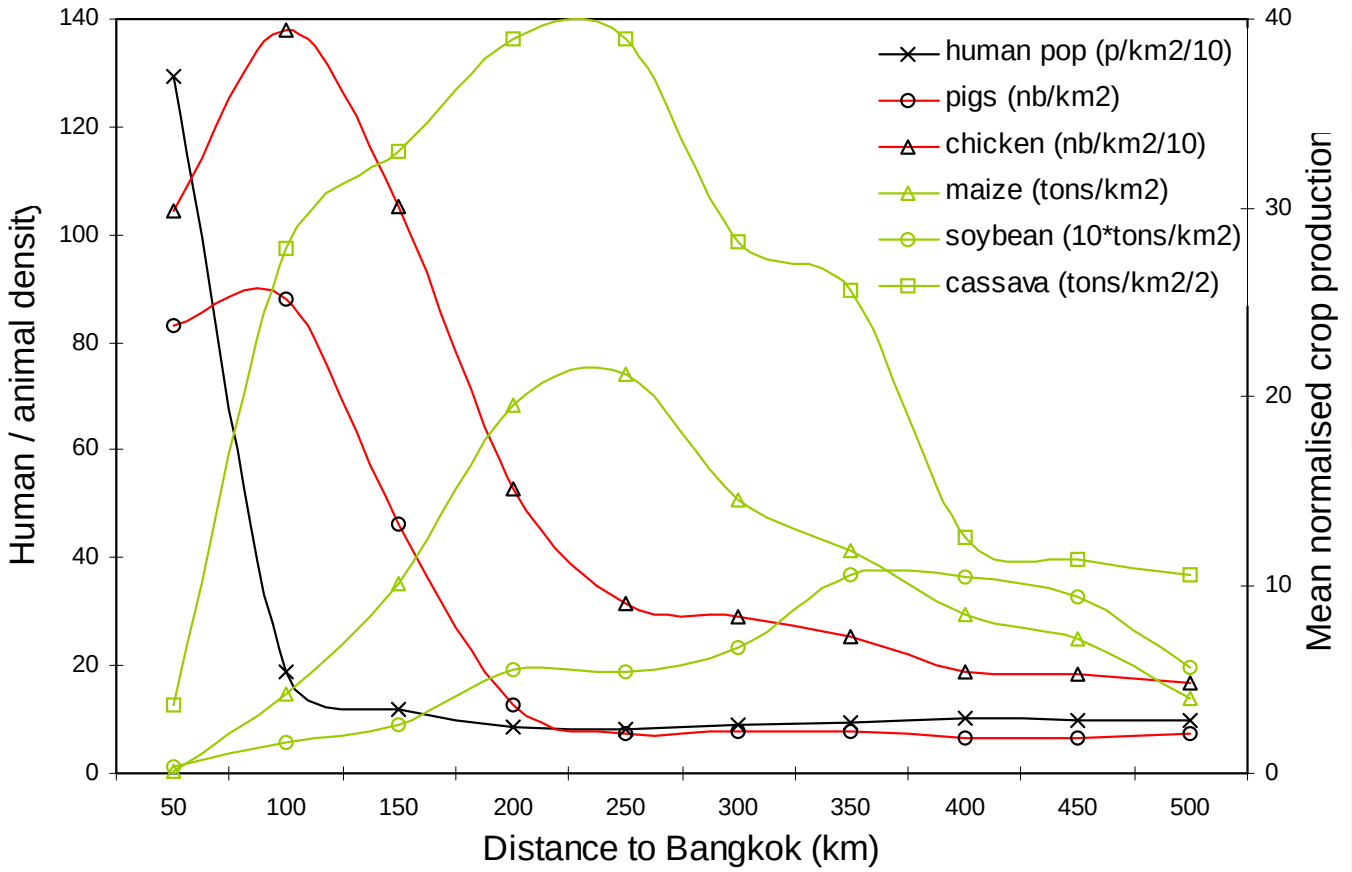
Estimated hotspots for nutrient overloads : Contribution of livestock

- ca. 24% of the crop area characterised by an overload (>10 kg P_2O_5/ha/year)
- Livestock contributes to ca. 39% of the P_2O_5 agricultural supply
- Hotspots in peri-urban areas and livestock specialised areas



Spatial distribution of humans, livestock and feed-crops around Bangkok, 2001





Purpose of the study

- Investigate the farm location effect on waste management practices
- Test the relative cost effectiveness of various policy options
- Test the effects of environmental policies on the sector's competitiveness.

Material and Methods (1)

Method

- Farm model
- Linear Programming (Hazell and Norton, 1986)
- Material flow accounting for Nitrogen, Phosphorus and water

Data

- Field survey
- Expert knowledge
- Thai Department of Livestock Development statistical yearbooks (1984 to 2004)

The linear programming model:

with:

$$\max Z = \sum_{j=1}^{n} c_j X_j$$

and:

$$\sum_{j=1}^{n} a_{ij} X_j \leq b_i$$

$$X_j \geq o$$

i: resources
j: activities

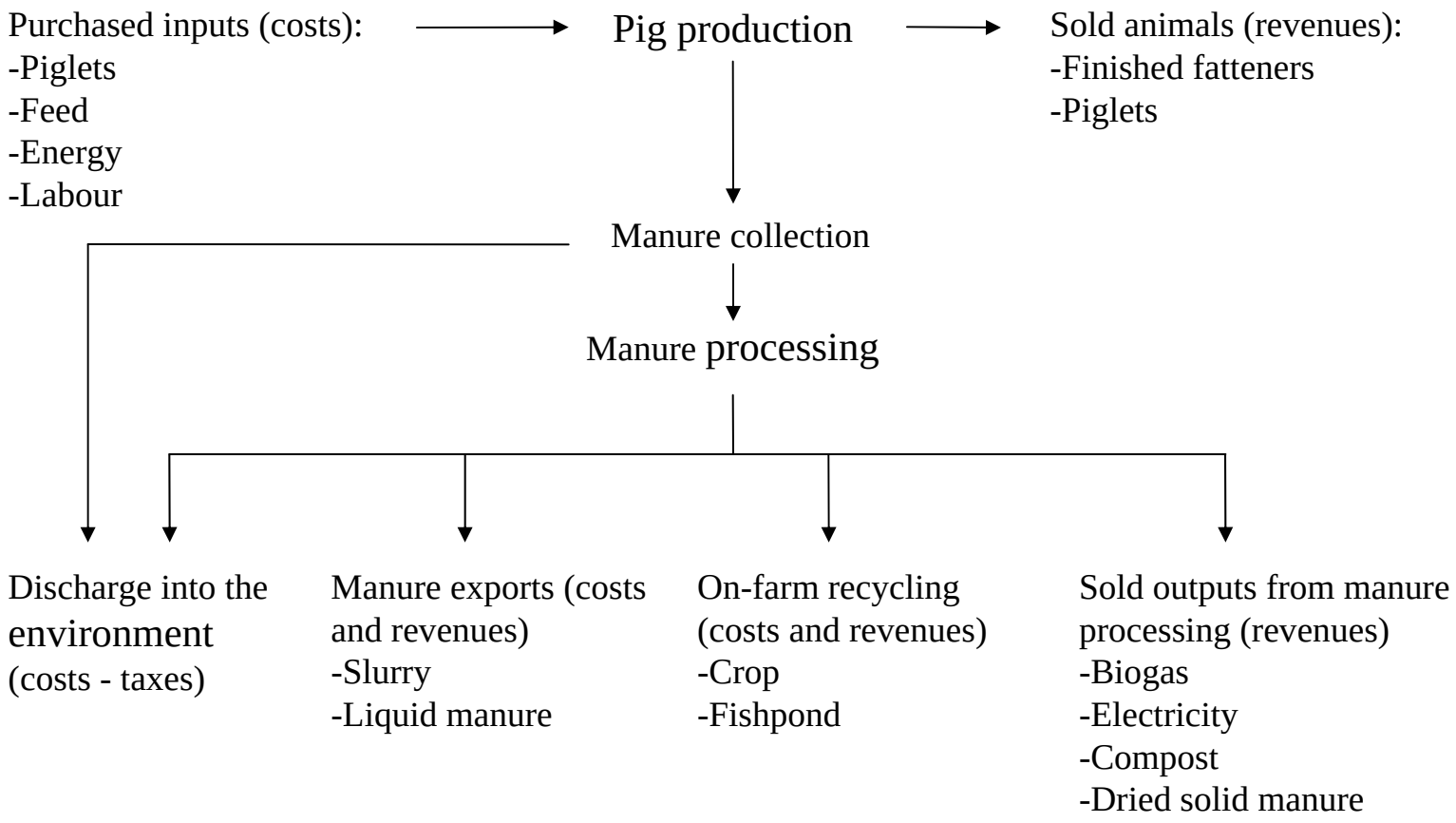
Material flow accounting

$$\sum_{a} e_a = \sum_{m} d_m + r_m + x_m + l_m$$

a: animals
m: management practices

Material and Methods (2)

Farm model



Material and Methods (3)

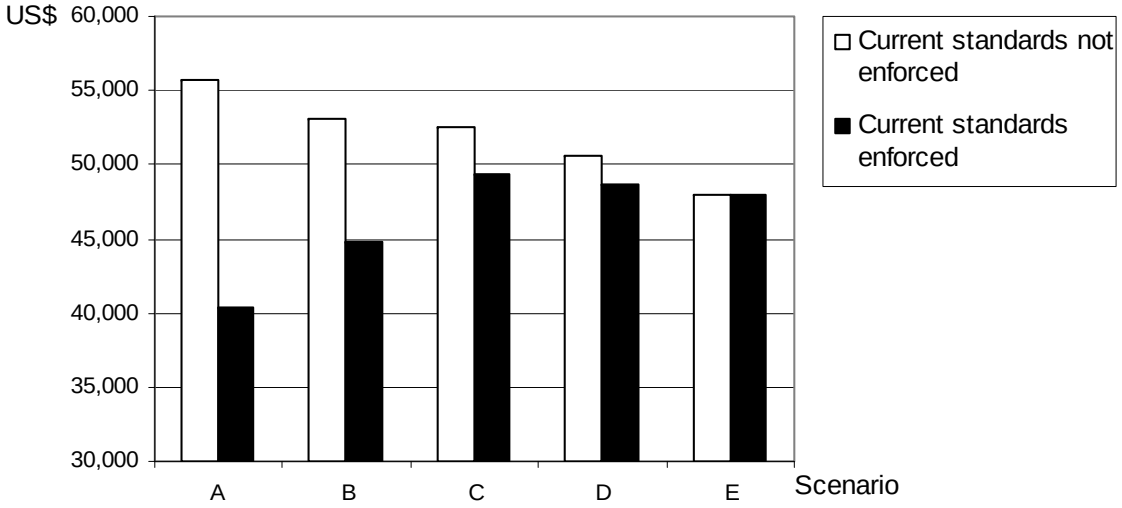
Scenario	Peri-urban		Rural		Cropping
	A	B	C	D	E
market demand for solid manure and compost	no	no	**yes**	**yes**	**yes**
market demand for slurry / liquid manure / digester outflow	no	no	no	no	**yes**
Possibility for the farm to crop on its own land	no	no	**crop**	**crop**	**crop**
Possibility for the farm to use biogas and/or electricity	no	**yes**	no	**yes**	**yes**
Transport cost for feed ($ per ton)	0	0	0	0	4
Transport cost for finished fatteners ($ per head)	0	0	**0.2**	**0.2**	**0.5**
Transport cost for piglets ($ per head)	0	0	**0.1**	**0.1**	**0.25**
Land price ($ per ha)	**30,000**	**30,000**	**9,000**	**9,000**	**4,500**
Standing pig population (heads more or less 10%)	2,000	2,000	2,000	2,000	2,000
Farm area (ha)	1	1	1	1	1

Results (1)

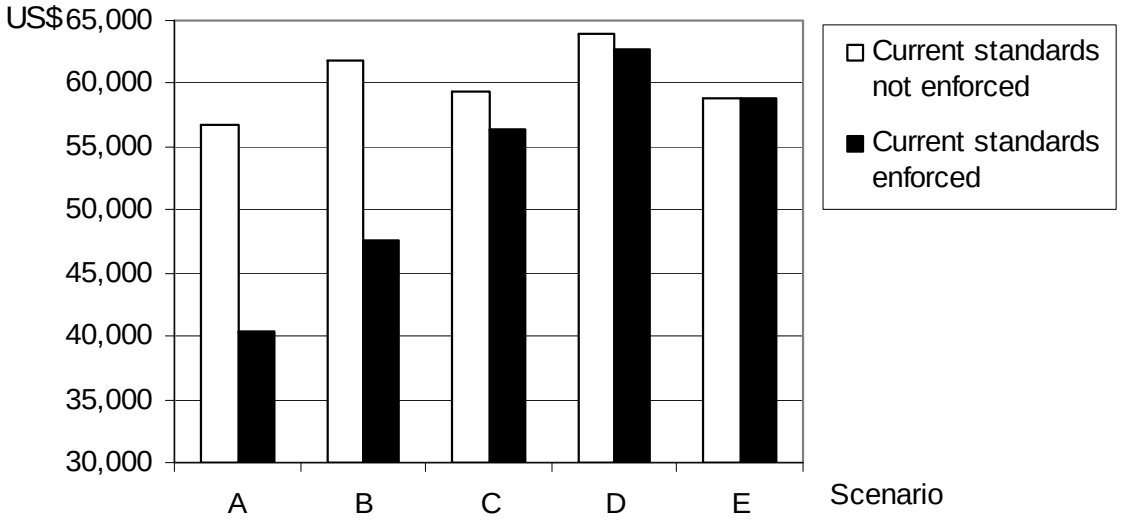
Scenario	**A** Peri-urban	**B** Peri-urban with biogas prod.	**C** Rural	**D** Rural with biogas prod.	**E** Rural with
Modelled farm performance under NO ENVIRONMENTAL POLICY					
N_{total} discharged by the production site (t/year)	19.8	17.9	15.7	14.2	0
BOD discharged by the production site (t/year)	220.0	76.1	65.6	19.7	0
N_{total} recycled on the farm (kg/year)	0	0	96.1	90.8	105.8
Modelled farm performance under CURRENT STANDARDS					
N_{total} discharged by the production site (t/year)	1.2	1.2	3.0	3.0	0
BOD discharged by the production site (t/year)	1.5	1.5	1.5	1.5	0
N_{total} recycled on the farm (kg/year)	0	0	25	38.1	105.8

Results (2)

Yearly **profit from pig marketing** under selected location and policy scenarios

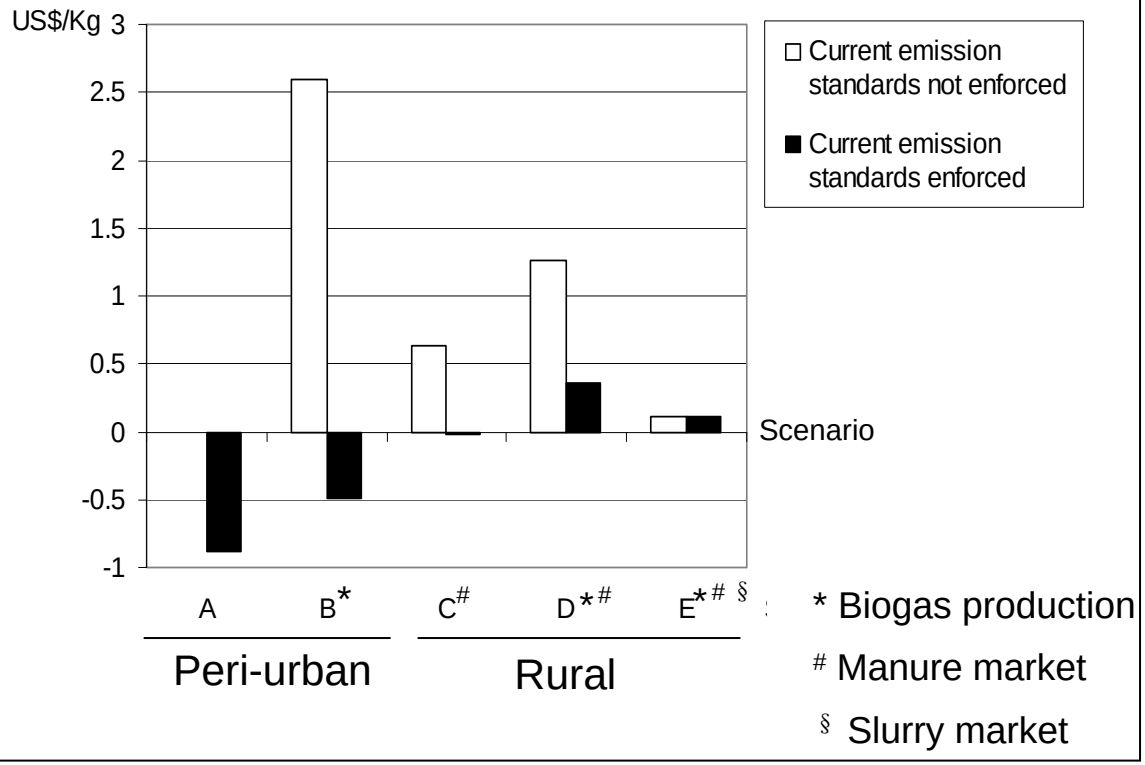


Yearly **farm profit** under selected location and policy scenarios



Results (3)

Variation of farm profit per unit of N emissions reduction for selected scenarios, with reference to location A under no enforcement of discharge standards



Conclusions (1)

- Farms located in peri-urban environments have greater costs of compliance with pollution control measures than farms located in rural areas (ca. US$15,000 Vs ca. US$3,000)
- In rural areas we observe win-win situations: increase in farm's profit with reduction of N emissions
- Relocating farms would achieve a reduction of pollution but generally not entirely solve the pollution issue

Conclusions (2)

Policy implications

- Win-win situations are found on a minority of farms: policies are required for a large adoption of improved manure management practices: in most cases, improving manure management practices will have a net cost for the farmers
- Generally no impact of environmental policies on sector's competitiveness
- Environmental policies should be enforced gradually and include a strong capacity building component
- Policy should aim at a better spatial distribution of production units
- Complementarities among policy instruments: spatial distribution, emissions from the production site and manure recycling

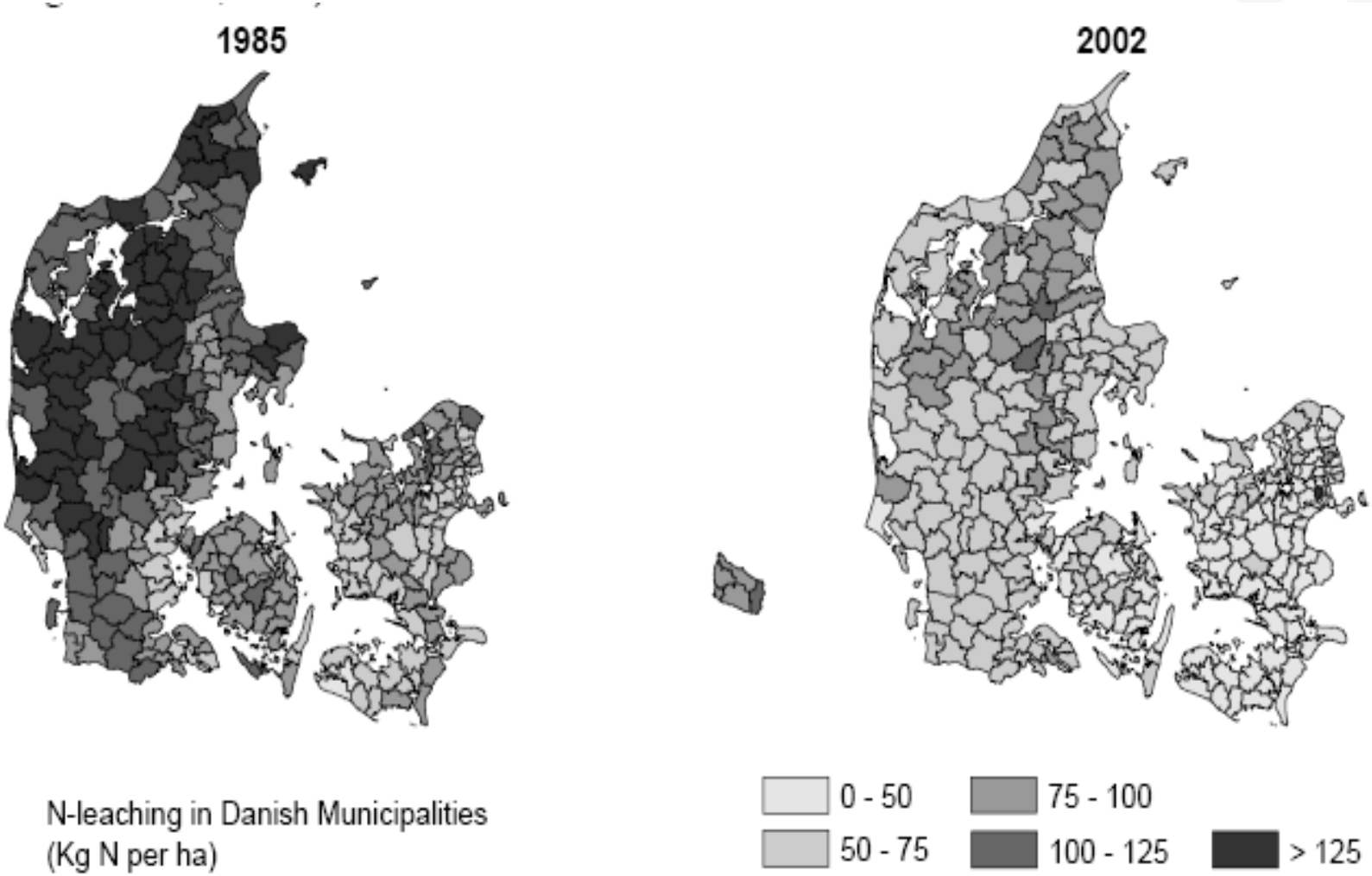
Pollution control instruments for intensive animal production

Mechanism	Level of application	
	Inputs/practices	Emissions
Taxes/subsidies	- Charges on fertilises - Subsidies for manure management facilities - Subsidies for retiring resource from production - Subsidies for improved animal feed	- Charges on modelled pollution emissions - Charges on nutrient applications in excess of crop needs
Standards and regulation	- Land use planning - Environmental permits - Compulsory nutrient management plans - Feed additives and drugs regulation - Regulations on manure storage	- Discharge standards - Ban on manure discharge to surface water - Regulations on land application of manure
Markets		- Tradable rights and quotas

Pollution control instruments for intensive animal production

Mechanism	Level of application	
	Inputs/practices	Emissions
Contracts/bounds	-Contracts involving the adoption of best manure management practices -Contracts with local communities or private sector for pollution reduction	
Communication	-Awareness raising of farmers -Capacity building on good manure management practices	-Awareness raising of farmers and communities
Liability	-Negligence rules	-Strict liability / negligence rules

Nitrate leaching in Denmark



N-leaching in Danish Municipalities
(Kg N per ha)