Ecological Recycling Agriculture:

Integrating animal and crop production

BERAS implementation
Baltic Ecological Recycling Agriculture and Society

Södertörn University Sweden

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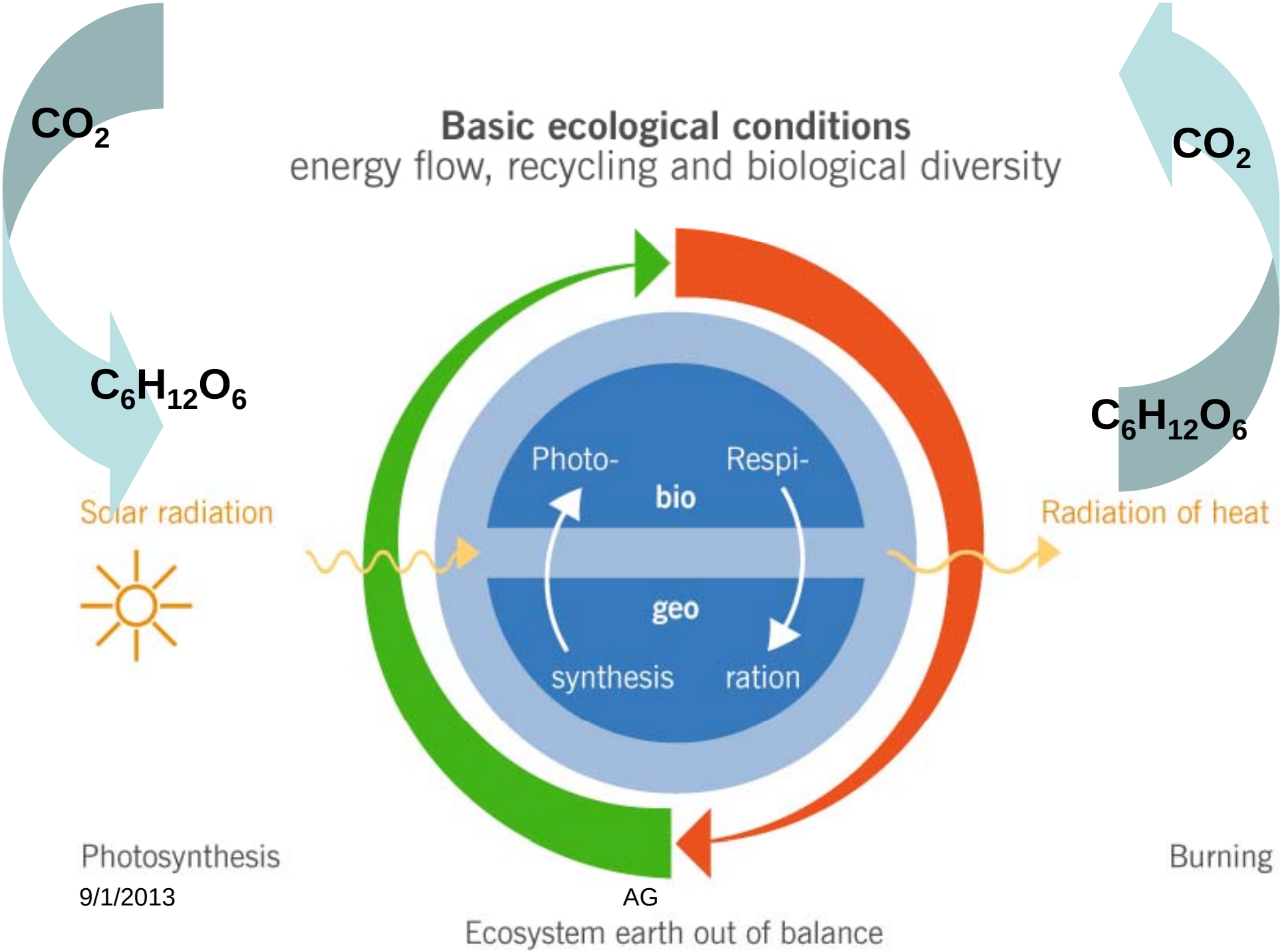
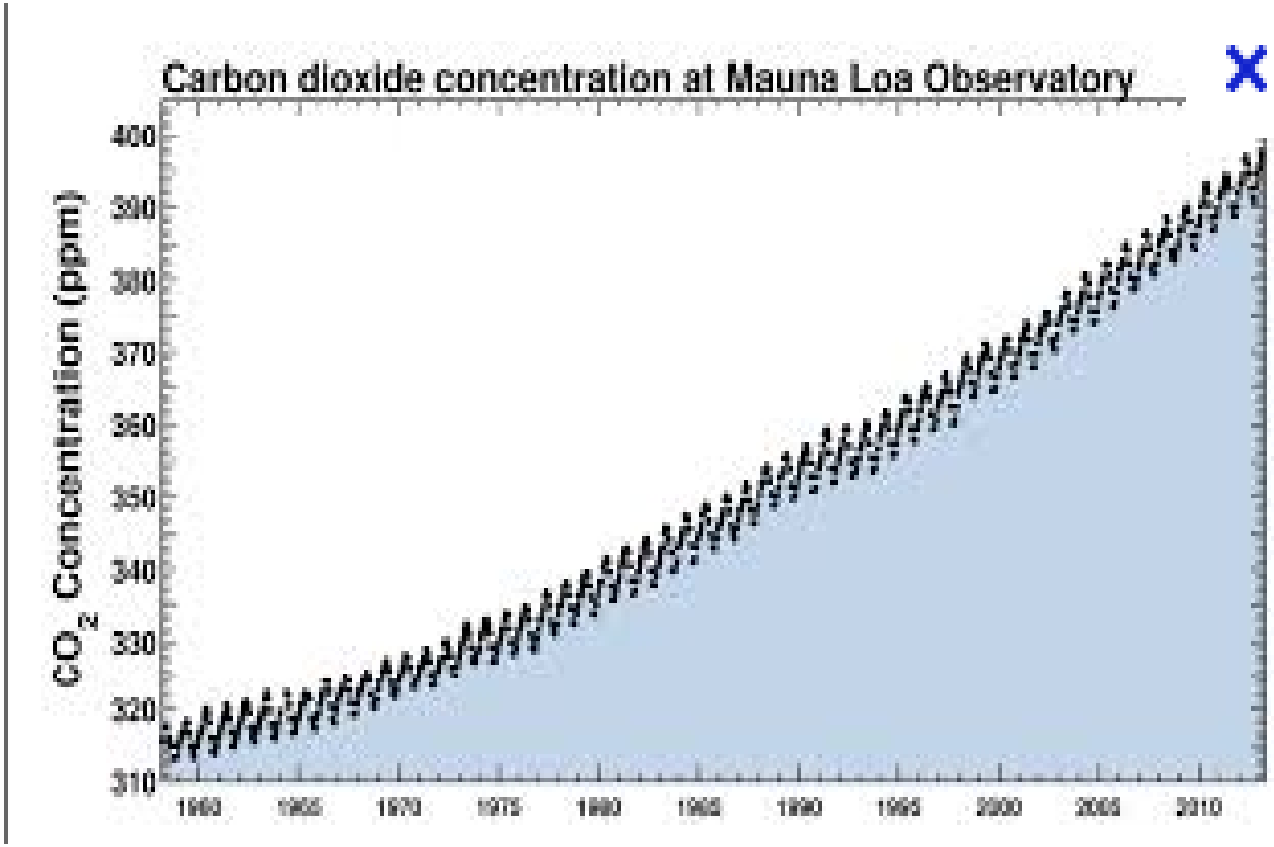
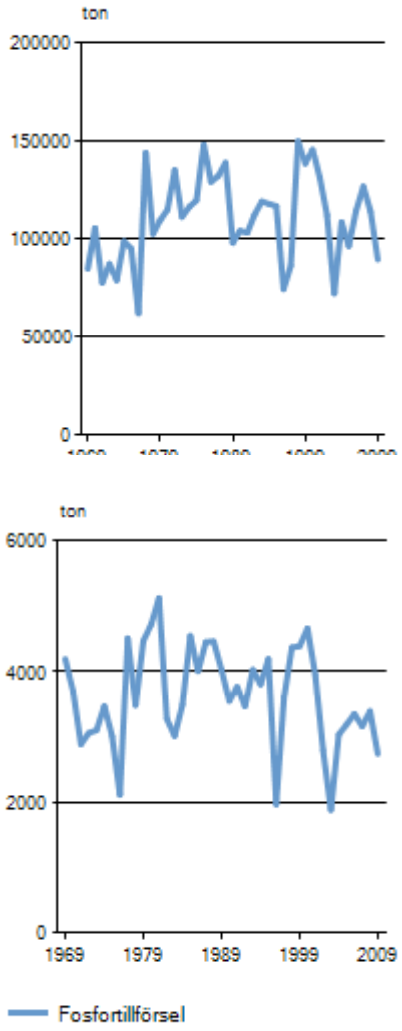
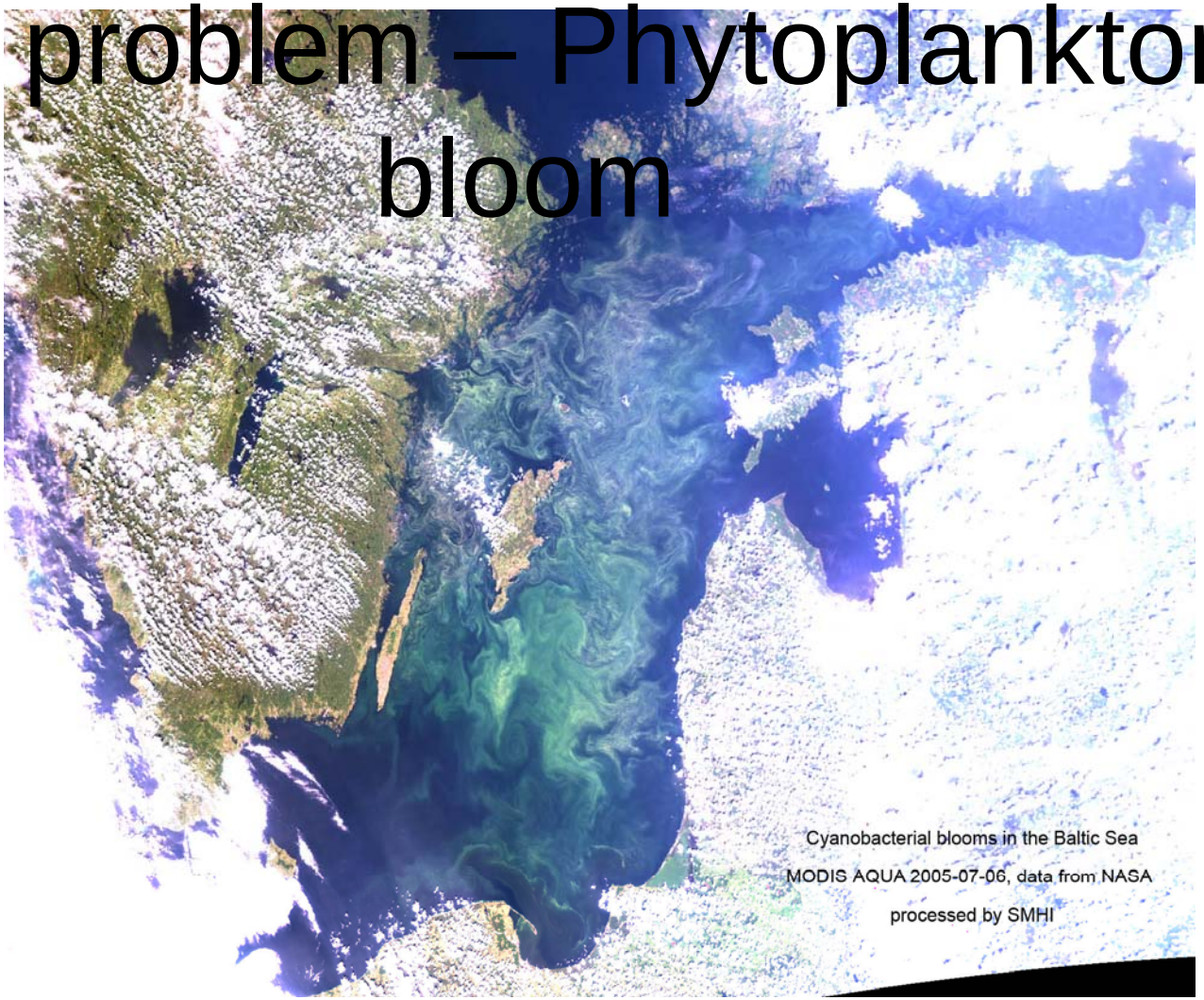

Basic ecological conditions
energy flow, recycling and biological diversity
CO_2
$C_6H_{12}O_6$
Solar radiation
Photo-
Respi-
bio
geo
synthesis
ration
CO_2
$C_6H_{12}O_6$
Radiation of heat
Photosynthesis
Burning
Ecosystem earth out of balance

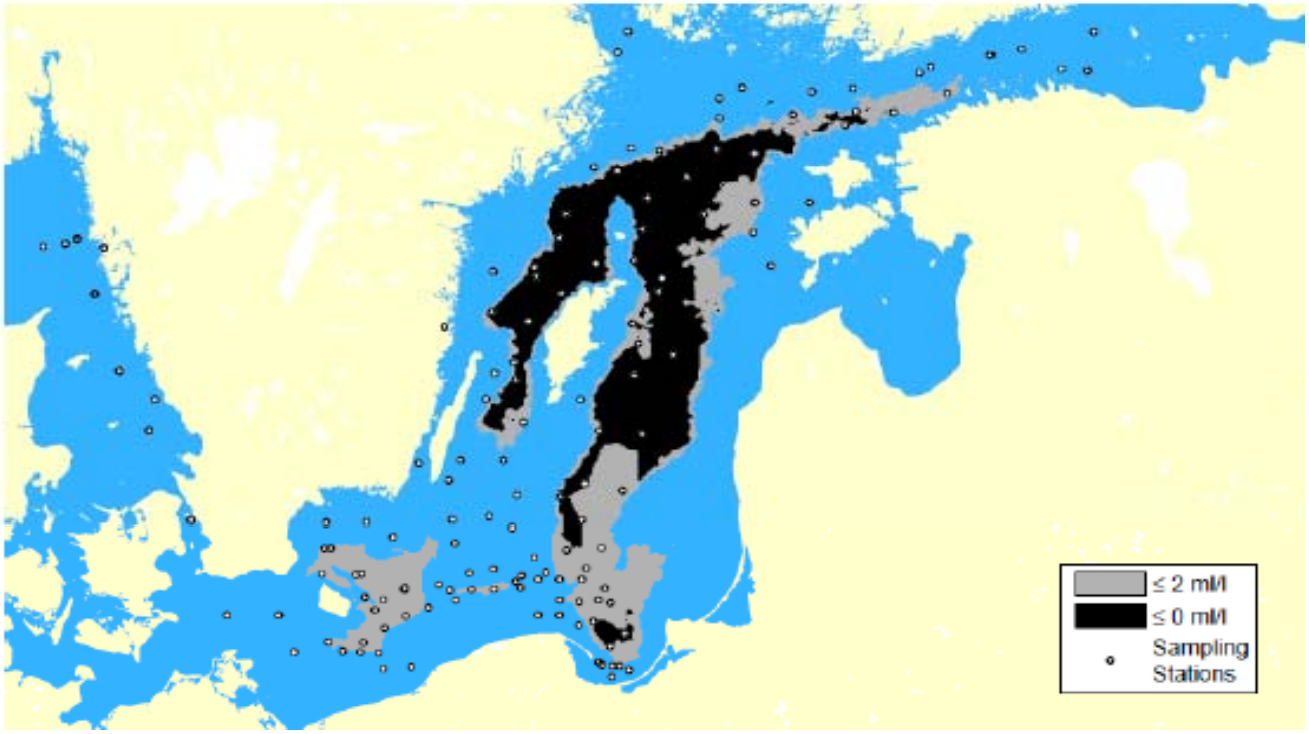
Ch. D. Keeling mobilized enough resources so he could, starting 1958, measure the CO_2 in the atmosphere on Mauna Loa observatory in Hawaii



The nitrogen and phosphorus surplus to the sea problem – Phytoplankton bloom





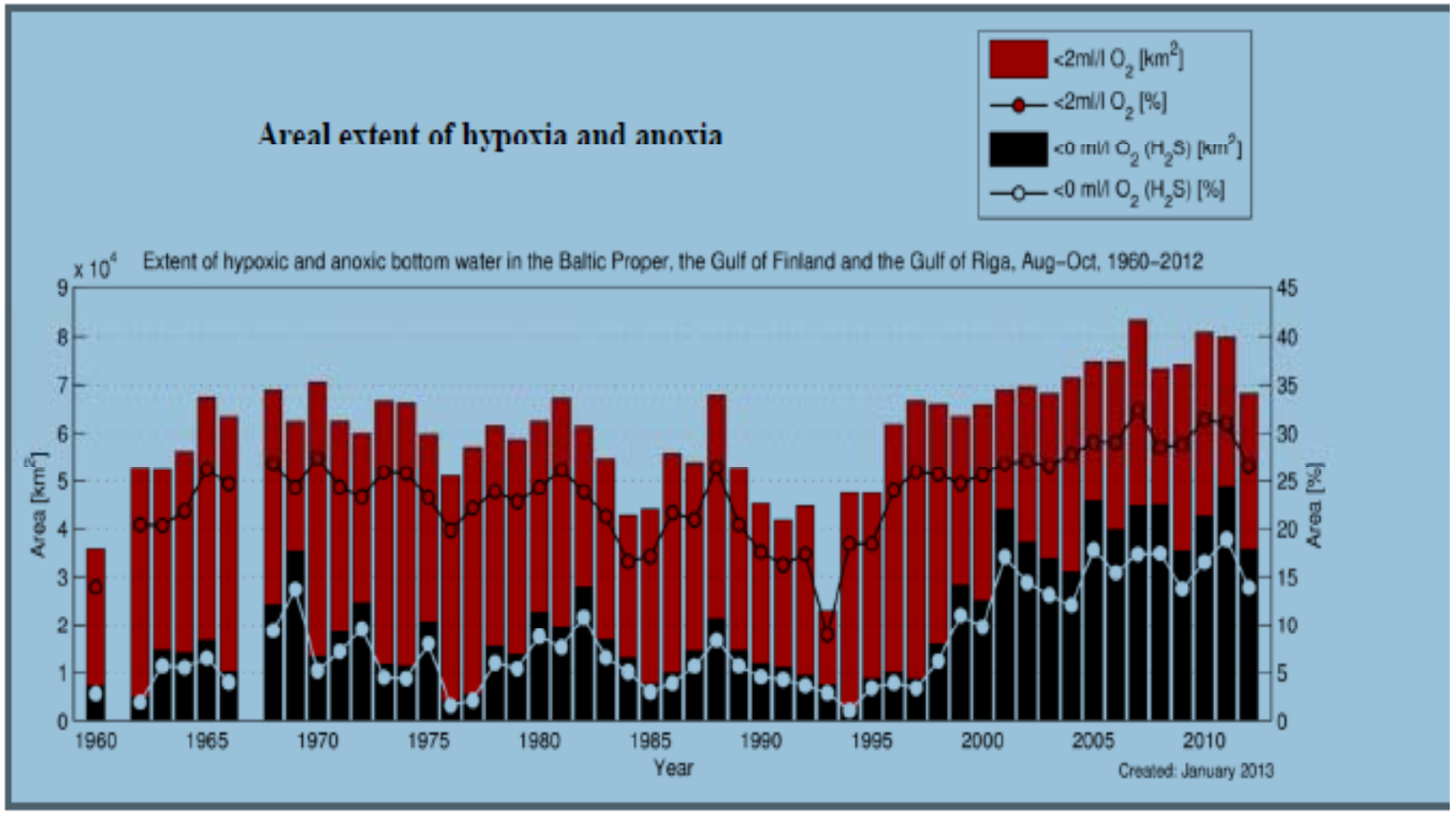
- **SMHI REPORT OCEANOGRAPHY No. 46, 2013.Oxygen Survey in the Baltic Sea 2012**
- **- Extent of Anoxia and Hypoxia, 1960-2012**
- **Martin Hansson, Lars Andersson, Philip Axe & Jan Szaron**
- 

- Figure 1. Areal extent of hypoxia (grey), anoxia (black) and sampling stations (dots) in the Baltic Sea during autumn 2012.

SMHI REPORT OCEANOGRAPHY No. 46, 2013.Oxygen Survey in the Baltic Sea 2012

- Extent of Anoxia and Hypoxia, 1960-2012

Martin Hansson, Lars Andersson, Philip Axe & Jan Szaron



· The updated results for 2011 and the preliminary results for 2012 show that the extreme oxygen conditions in the Baltic Proper continue. Both the areal extent and the volume of hypoxia and anoxia are elevated to levels never seen before.

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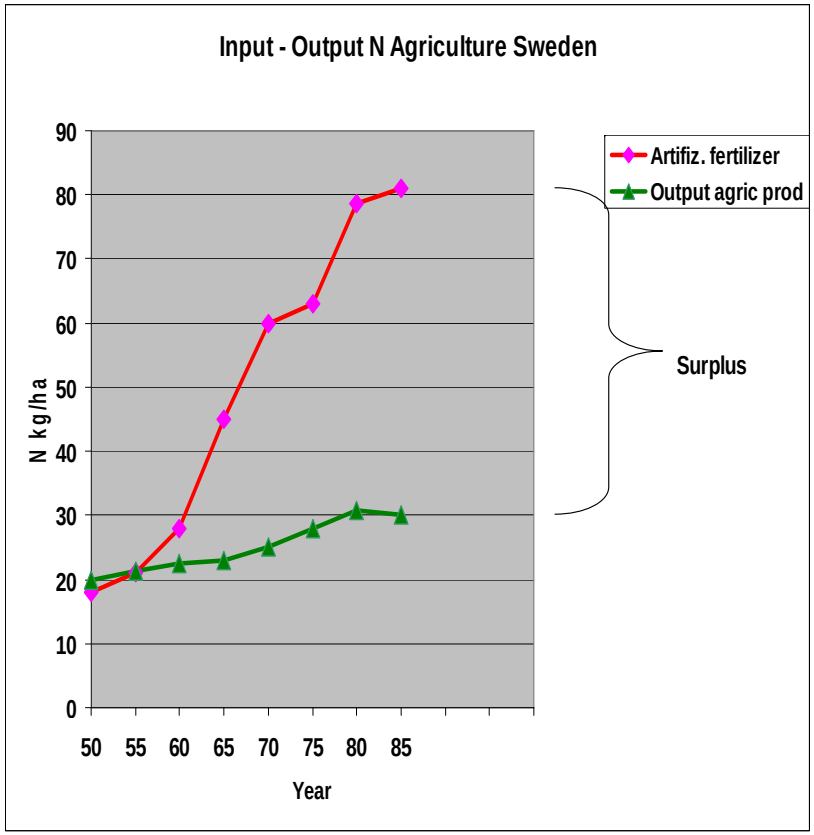
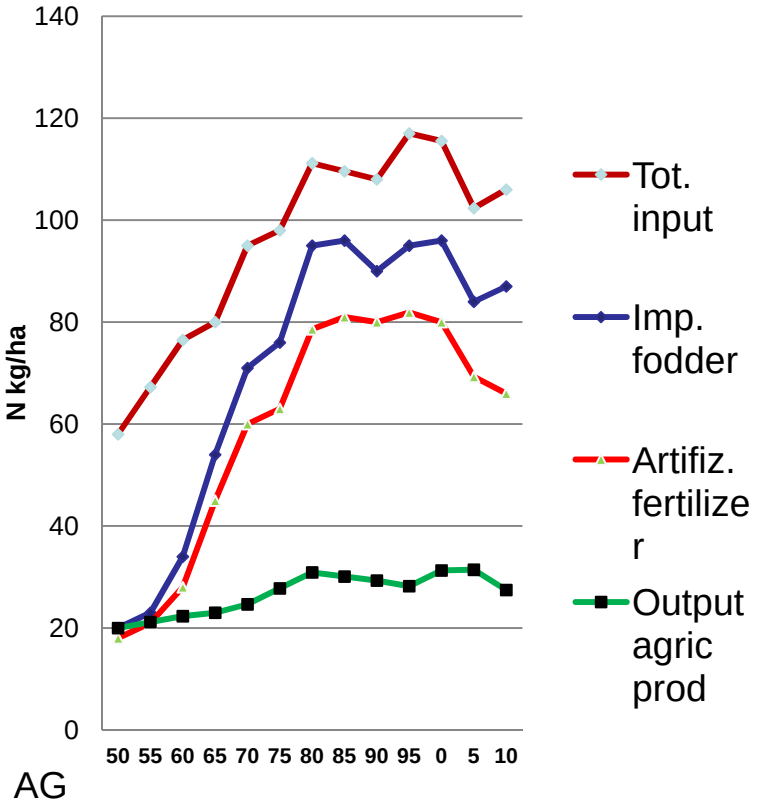
In Sweden, from 1950 to 1980 the average use of artificial nitrogen fertilizers increased from

20 kg to 80 kg per

ha and year 1950 -1980.



N-surplus kg/ha Swedish Agriculture 1950 - 2010



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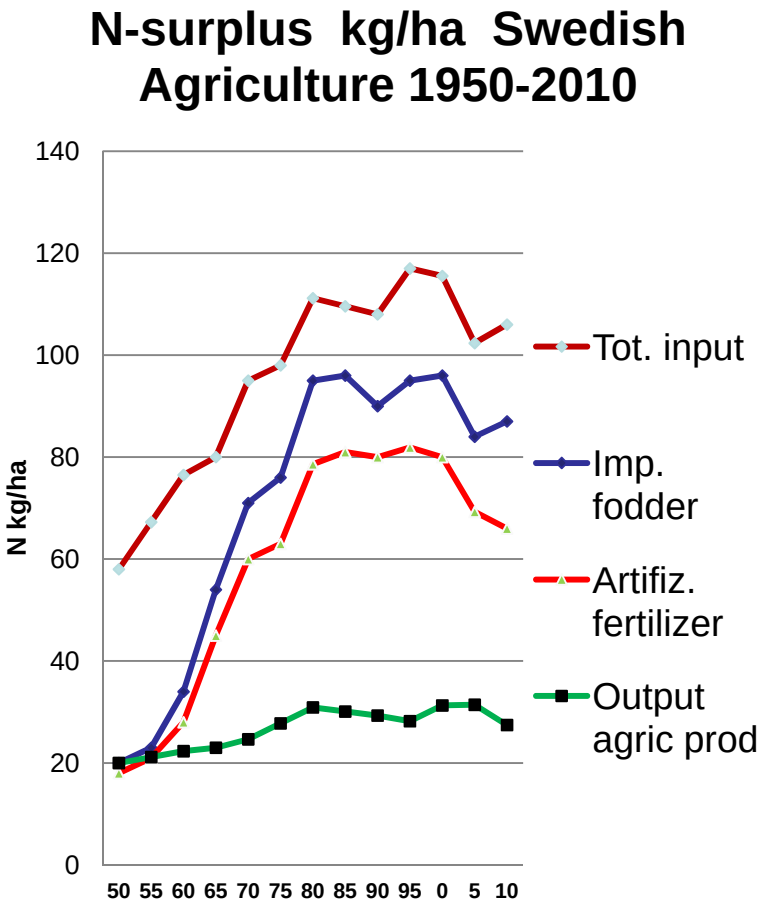
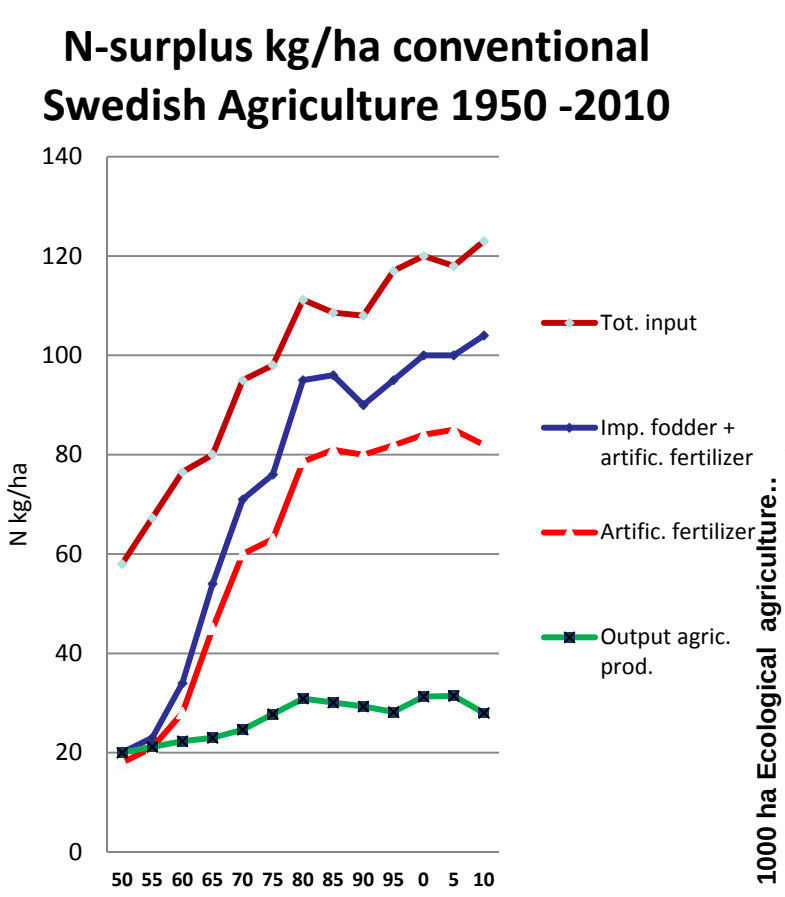
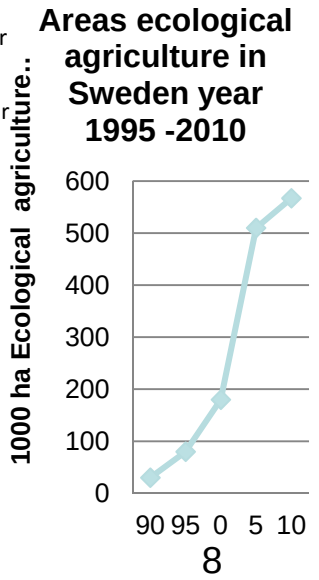
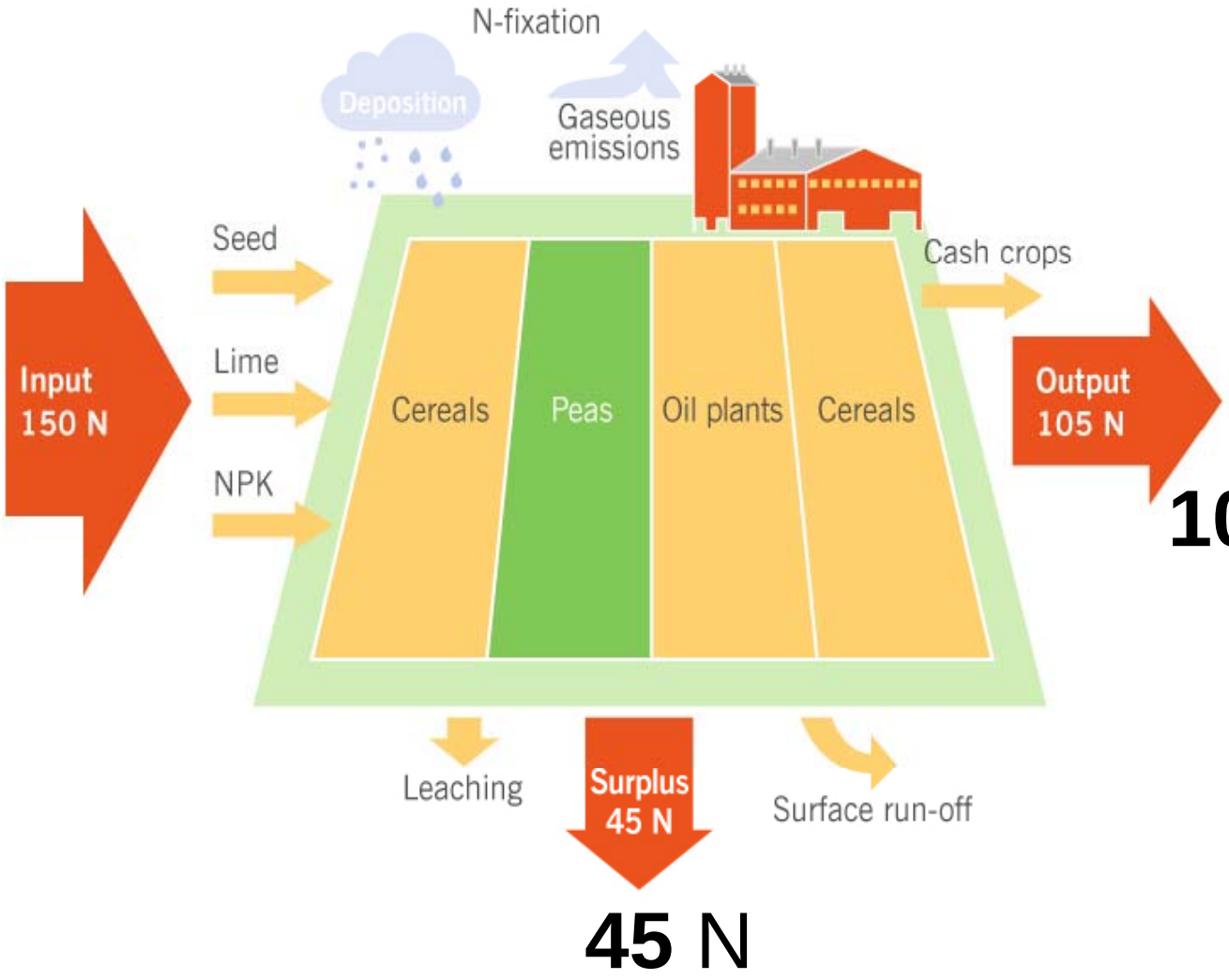

N-surplus kg/ha Swedish Agriculture 1950-2010
N kg/ha
140
120
100
80
60
40
20
0
50 55 60 65 70 75 80 85 90 95 0 5 10
Tot. input
Imp. fodder
Artifiz. fertilizer
Output agric prod


N-surplus kg/ha conventional Swedish Agriculture 1950 -2010
N kg/ha
140
120
100
80
60
40
20
0
50 55 60 65 70 75 80 85 90 95 0 5 10
Tot. input
Imp. fodder + artific. fertilizer
Artific. fertilizer
Output agric. prod.


Areas ecological agriculture in Sweden year 1995 -2010
1000 ha Ecological agriculture..
600
500
400
300
200
100
0
90 95 0 5 10

Specialized crop farm
Input, output and surplus of Nitrogen kg/ha and year
(Avarage 563 farms 2001 - 2006, data from Swedish board of agriculture report 2008:25)



150 N

105 N

45 N

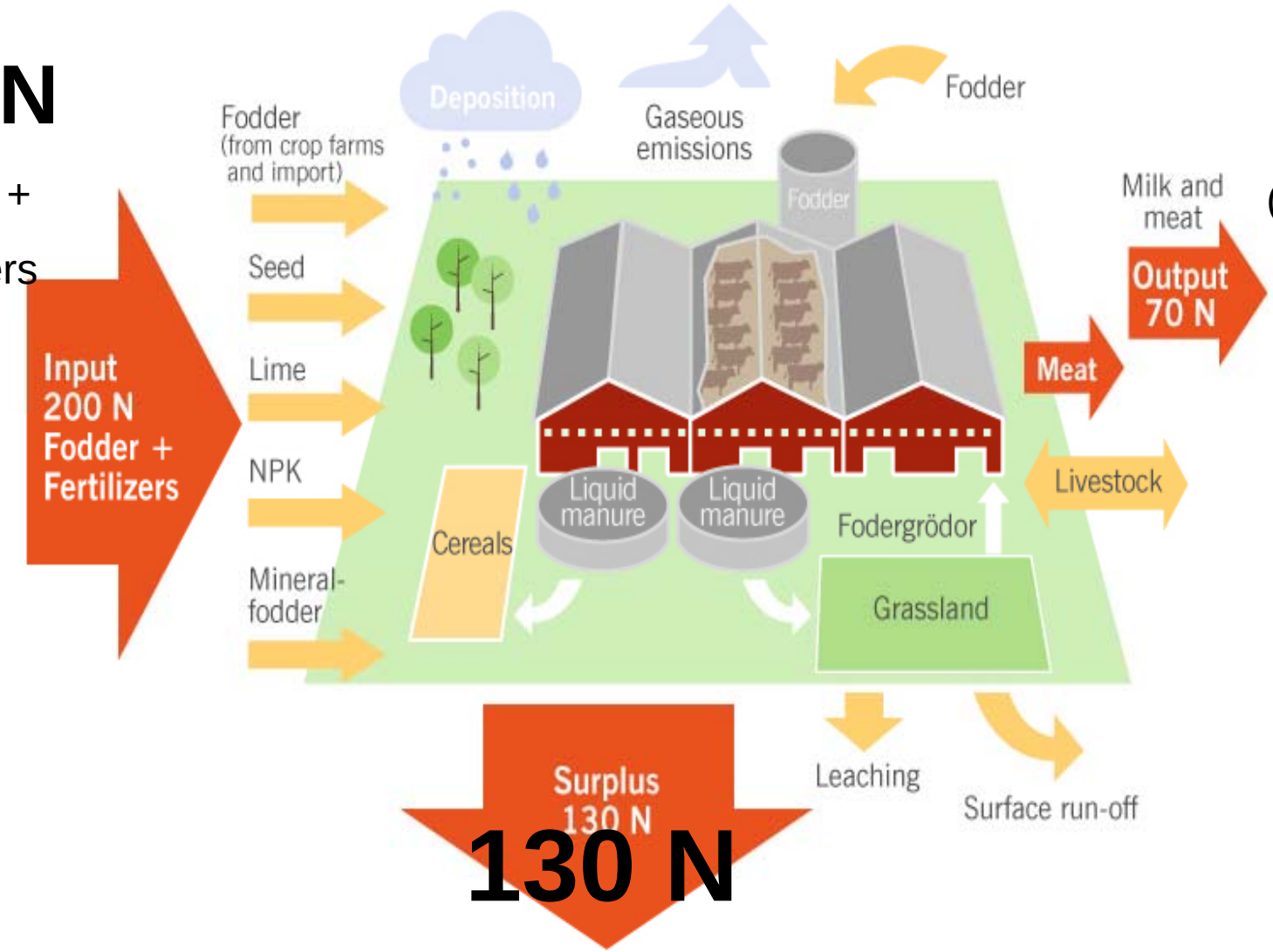
Specialized animal farm
Input, output and surplus of Nitrogen kg/ha and year

(Avarage 701 dairy farms 00-06, data from Swedish board of agriculture report 2008:25)

200 N

Fodder +

Fertilizers

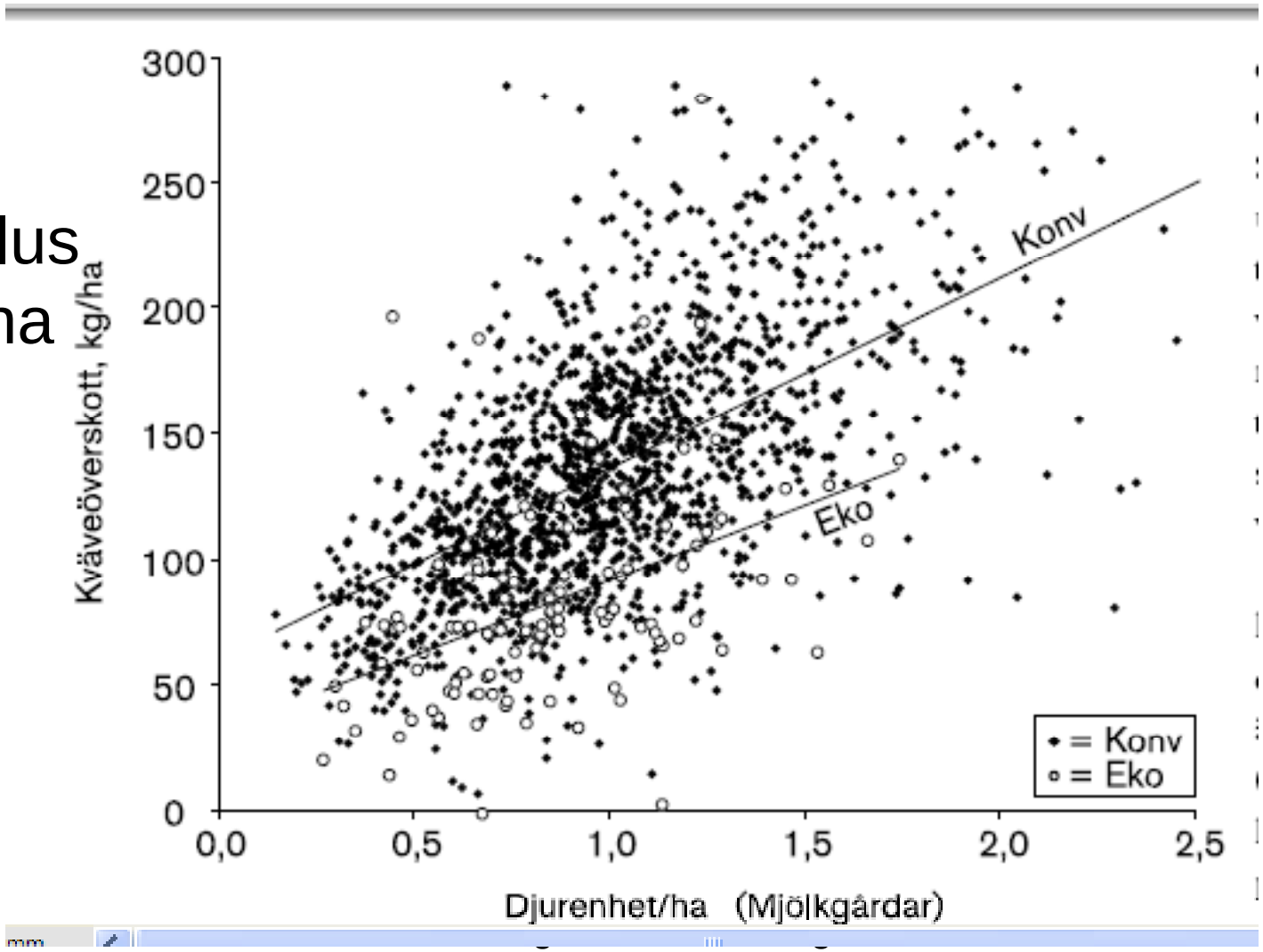


70 N

(Milk and meat)

130 N

N surplus kg/ha



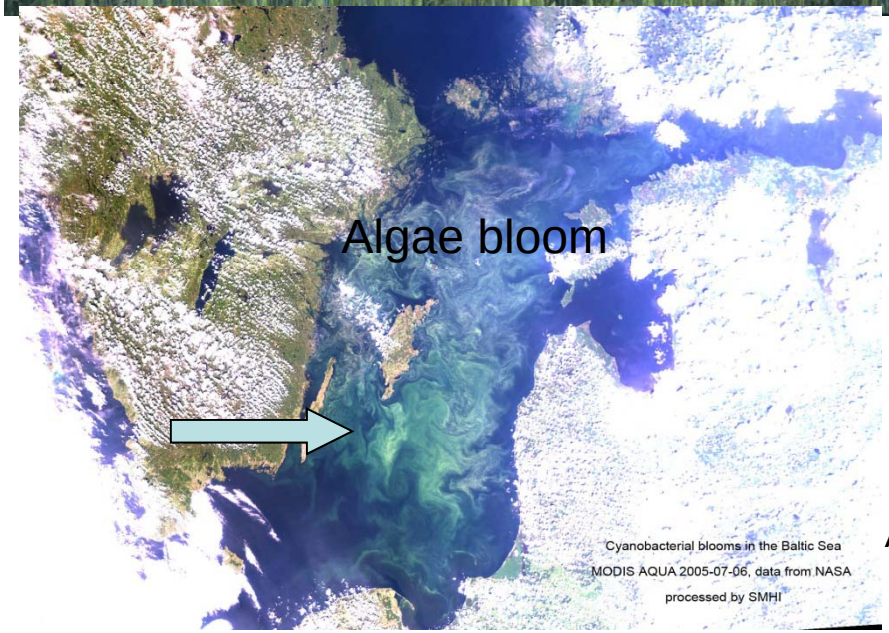
Anim. Units /ha

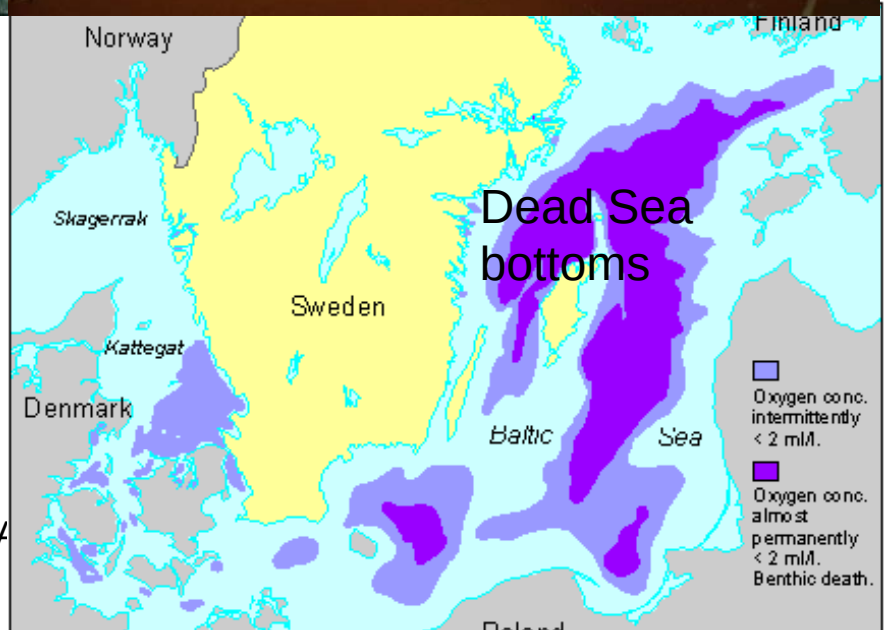
	Number of farms	N	P	K
Ecologiical production	**107**	**84**	**2,3**	**8,3**
Conventional production	**1517**	**136**	**4,0**	**11,7**

(Wivstad et al, SLU, 2008)

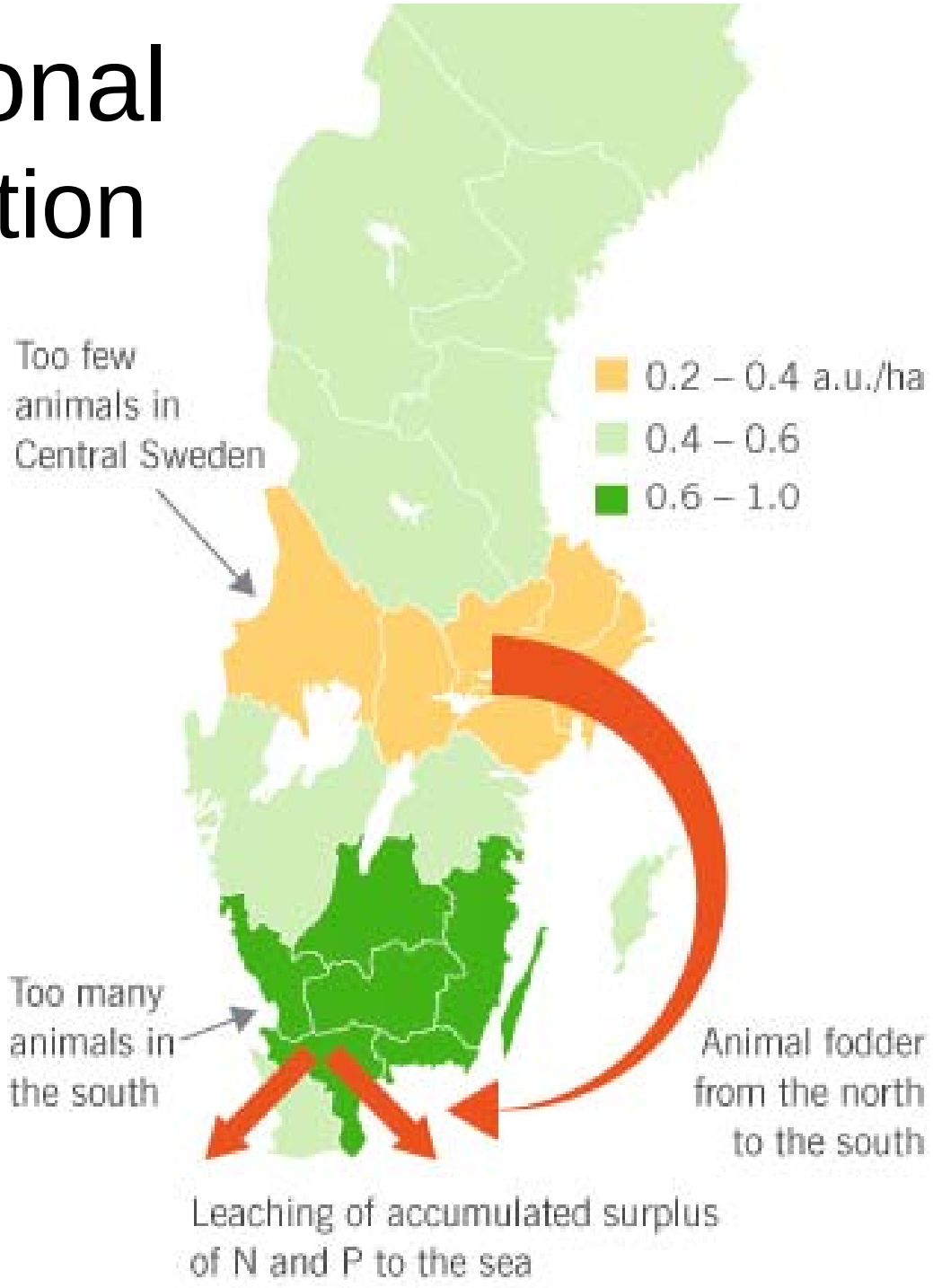

85 % of field yields


Become fodder for pigs, hens and cows
their surplus of manure leads to


Algae bloom
Cyanobacterial blooms in the Baltic Sea
MODIS AQUA 2005-07-06, data from NASA
processed by SMHI


Norway
Finland
Skagerrak
Sweden
Kattegat
Denmark
Baltic
Sea
Dead Sea bottoms
Oxygen conc. intermittently < 2 ml/l.
Oxygen conc. almost permanently < 2 ml/l. Benthic death.

With regional concentration

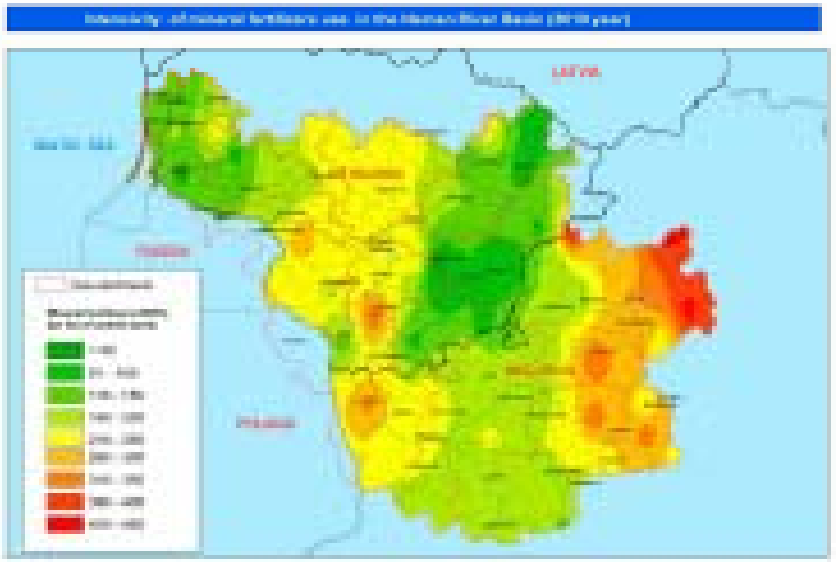


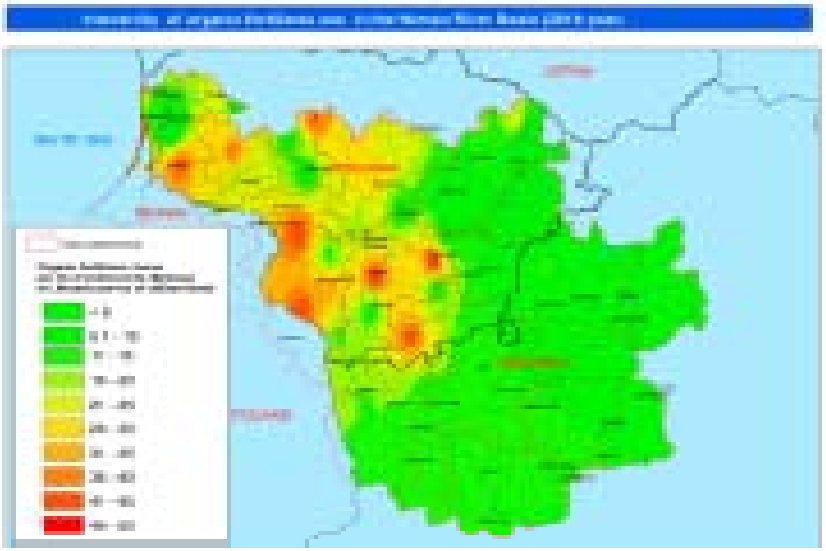
New EU states

- Partly nutrient extensive agriculture today
- Small-scale diversified farms (Poland)
- Large unused areas (Latvia)

➢ Risk for separation, specialisation and intensification

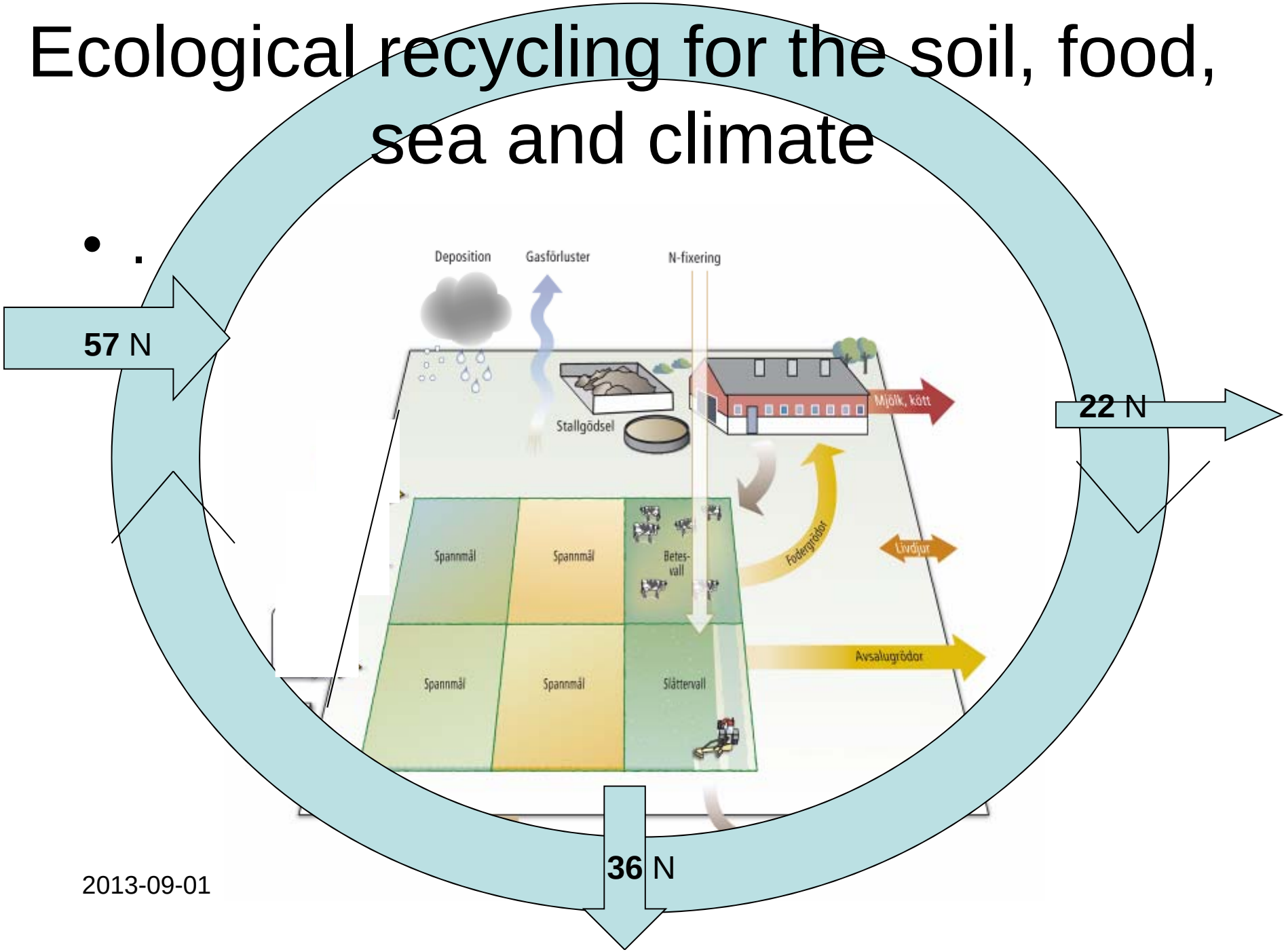
➢ Higher nutrient leakage



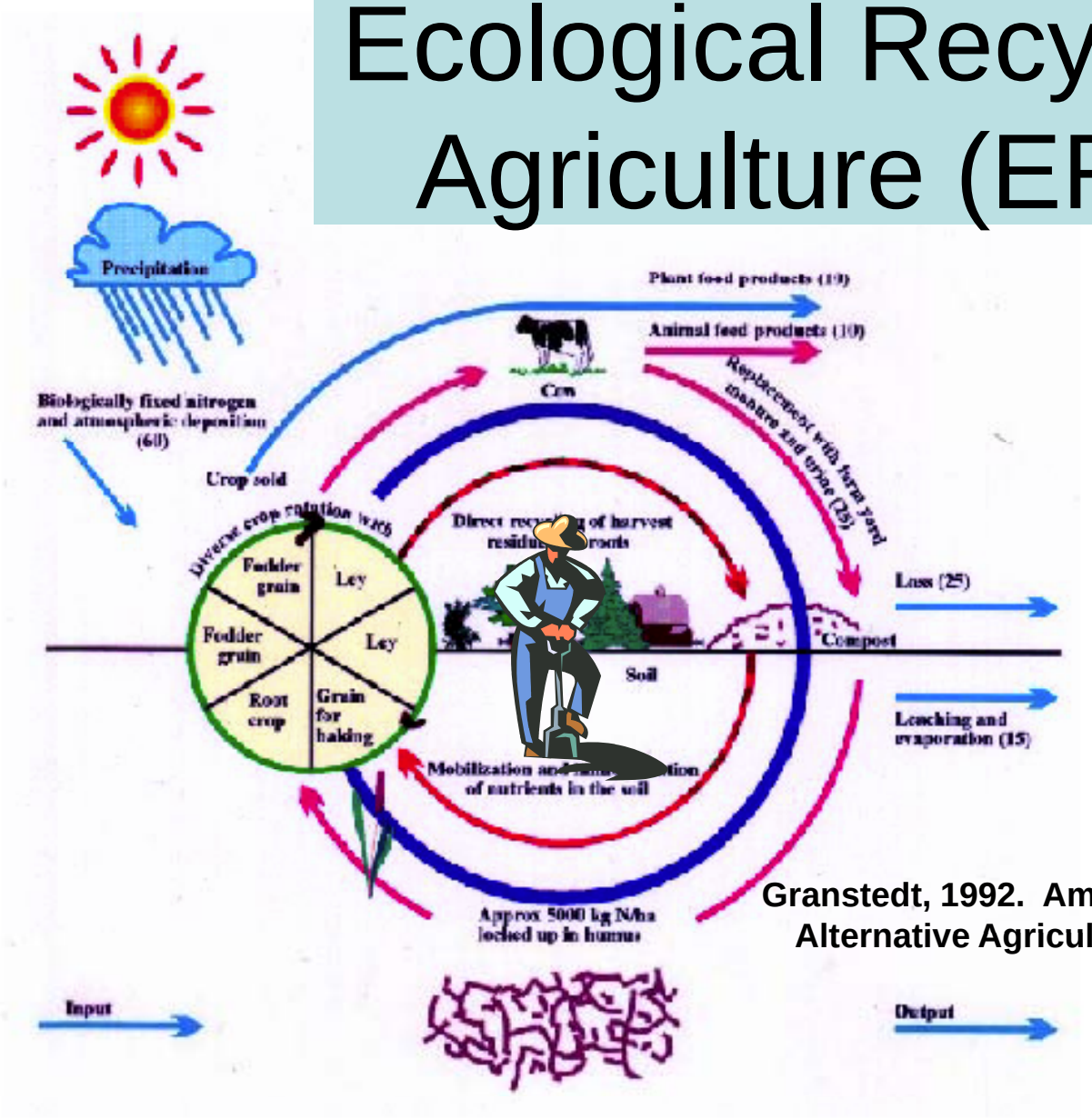


Ecological recycling for the soil, food, sea and climate

- .



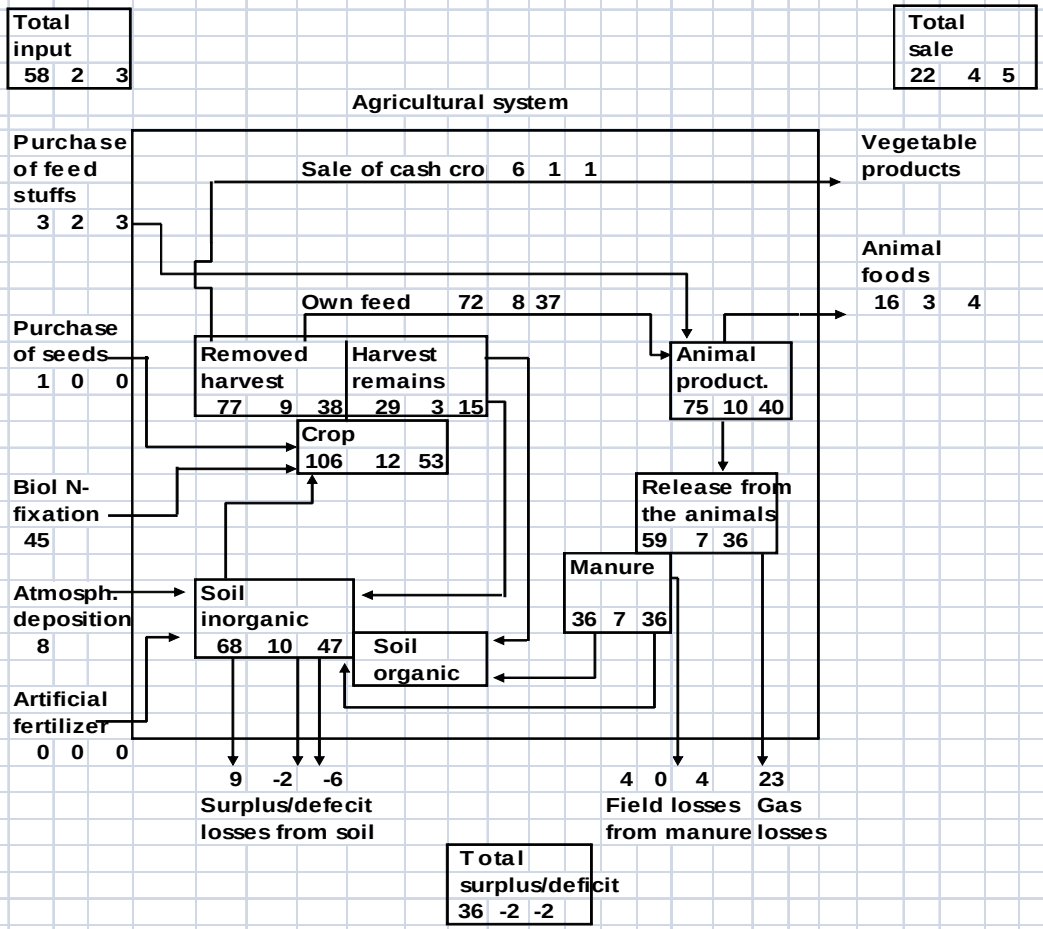
Ecological Recycling Agriculture (ERA)



Granstedt, 1992. American Journal of Alternative Agriculture, Washington

Flow of N/P/K kg ha^{-1} in the agricultural-ecosystem Yttereneby-Skilleby

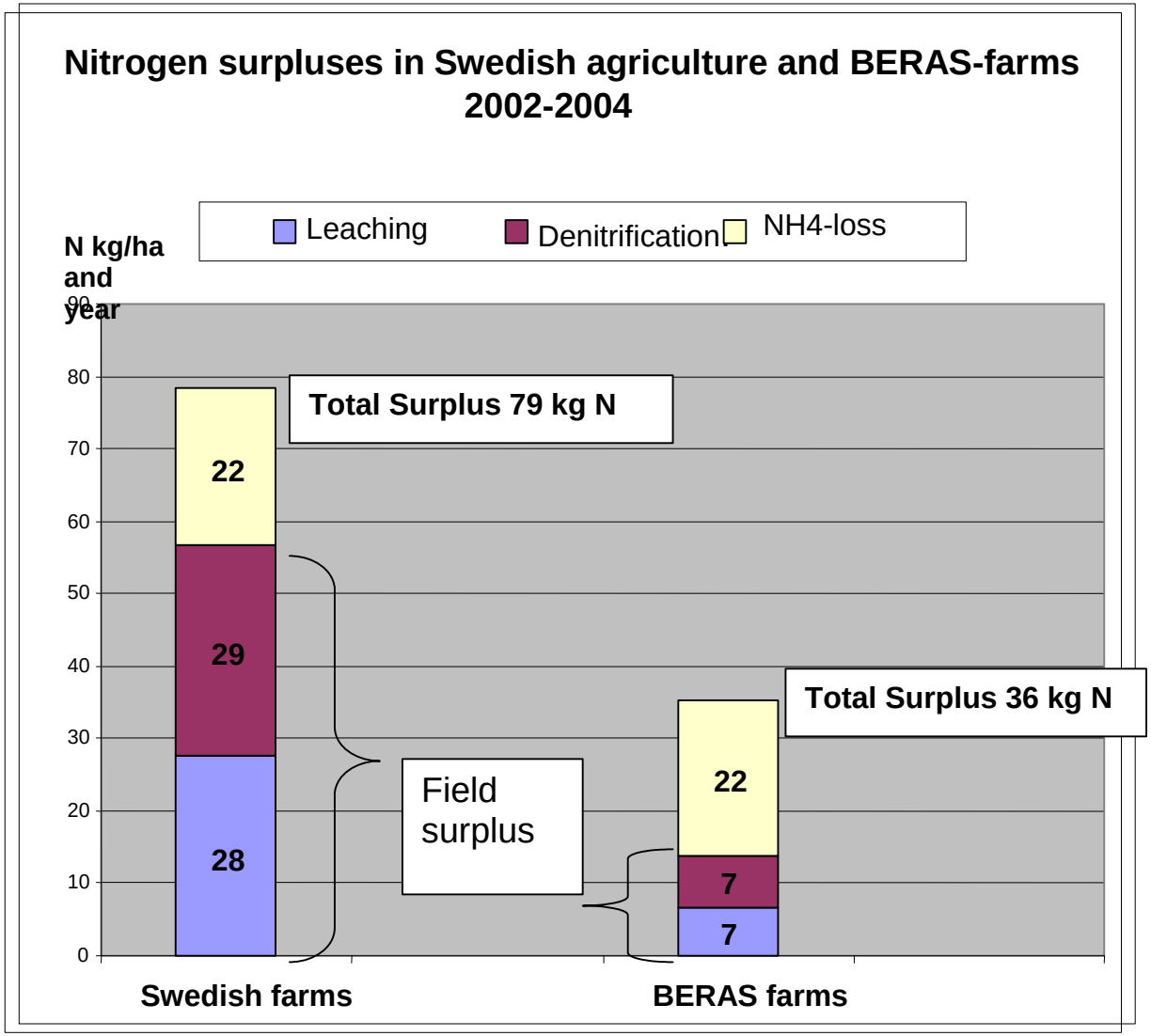
Dagfinn Reder (0,6 animal unit/ha) farm 2002-2003



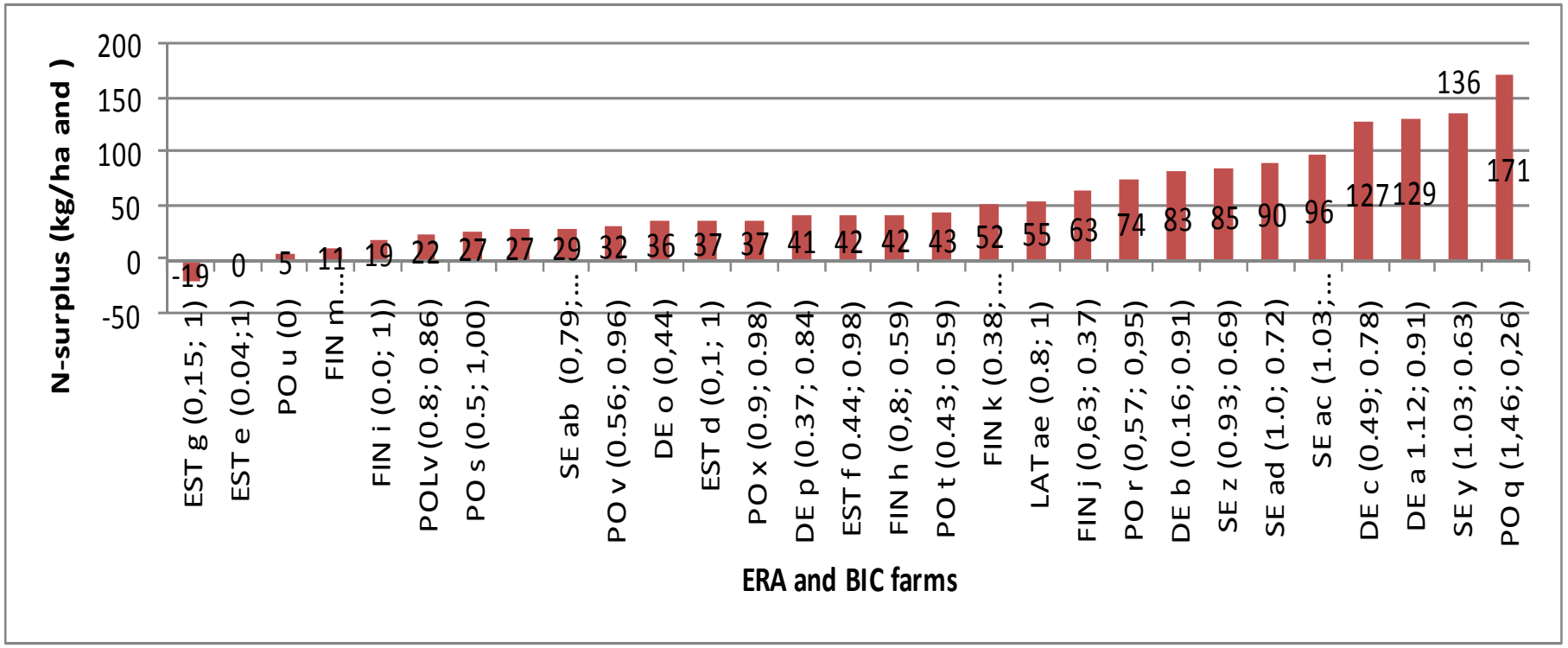
Calculation factors	N	P	K
Store losses from manure	0,4		
Field losses from manure	0,1	0,05	0,1
Fodder/animal production	4,6	3,0	10

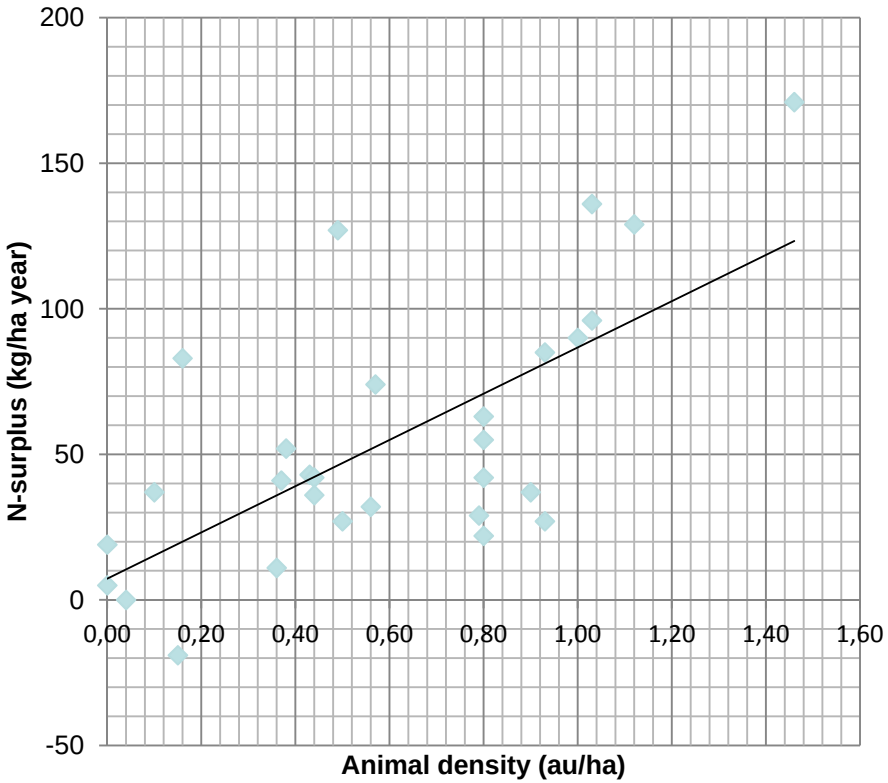
Given figures	N	P	K
Purchace to anim. pro	3	2	3
Purch. seeds	1	0	0
Biol. N-fix	45		
Atmosph. dep.	8		
Artificial fertilizer	0		
Crop export	5,5	1	1
Export of animal prod	16	3	4
Calculated values			
Own feed	72	8	37
Harvest remain	29	3	15

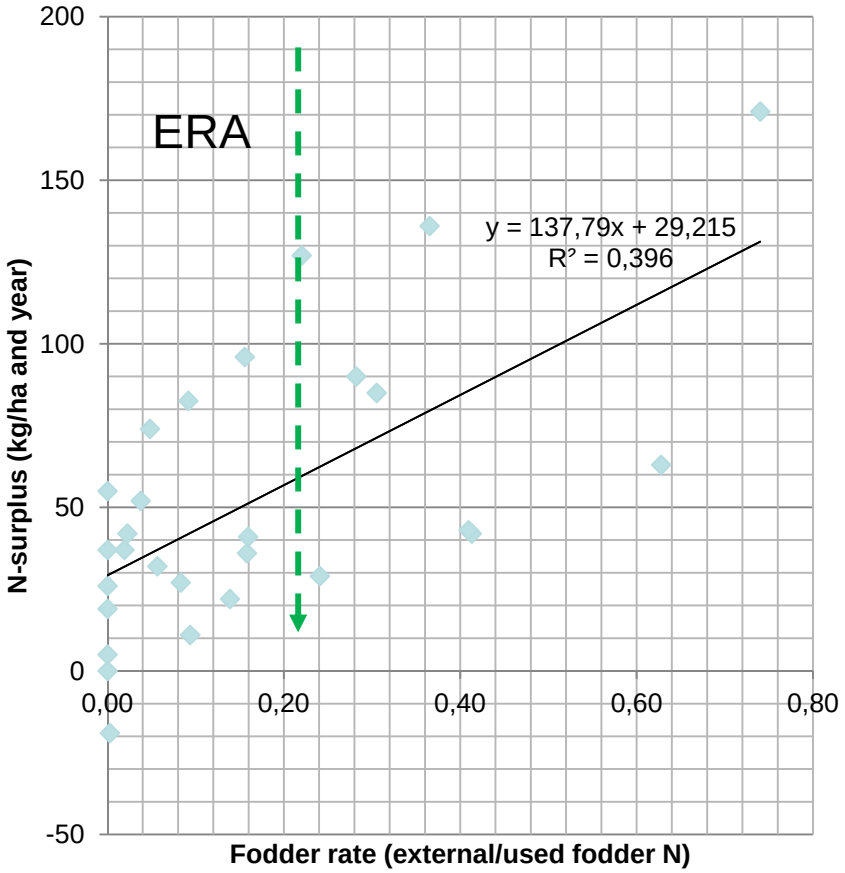
Primary nutrient balanceY/P= 1,39



The results indicate 70 – 75 % lower leakage of nitrogen from BERAS-farms compared to the conventional agriculture.

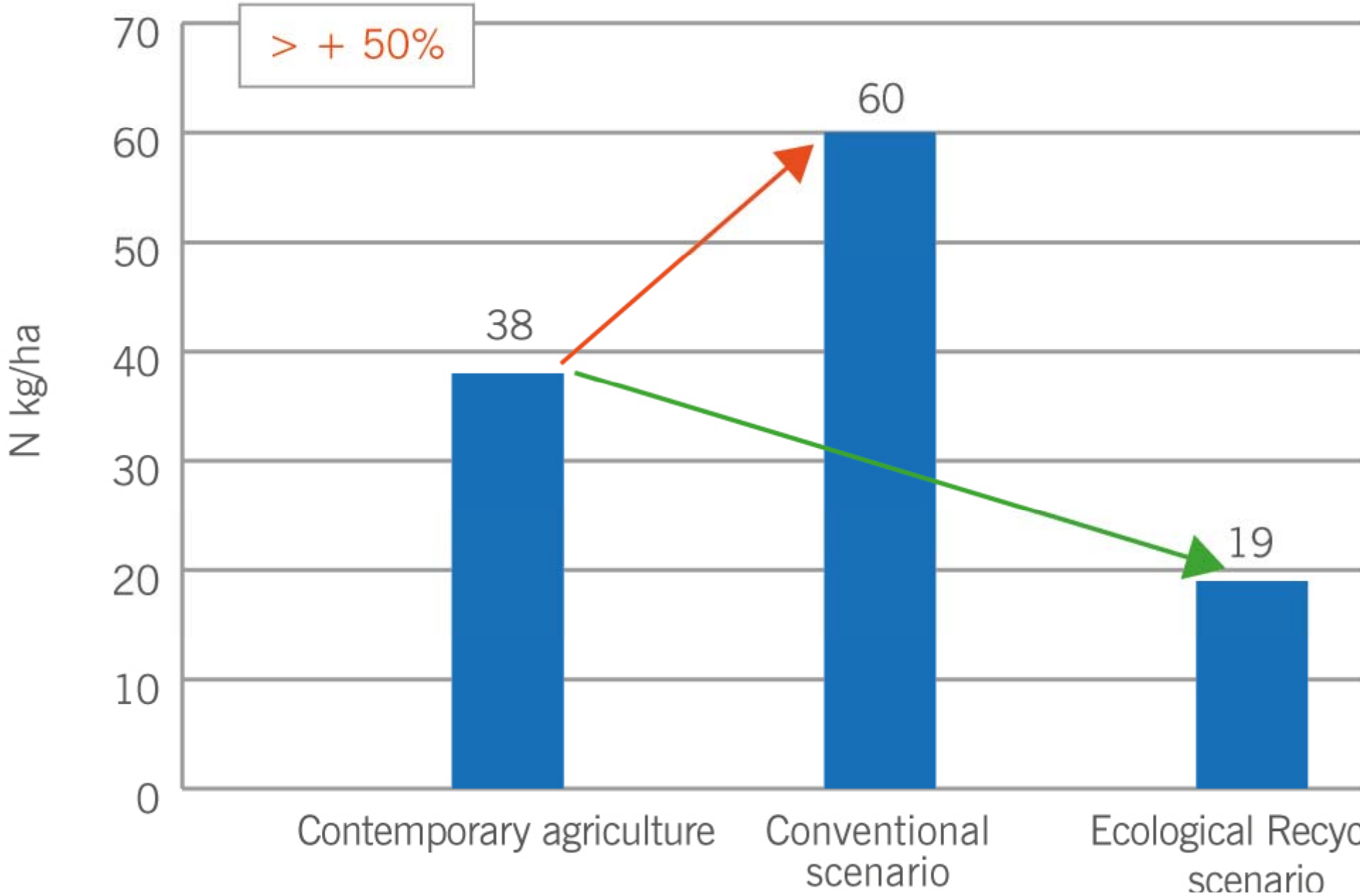

N-surplus (kg/ha and)
200
150
100
50
0
-50
-19
0
5
11
19
22
27
27
29
32
36
37
37
41
42
42
43
52
55
63
74
83
85
90
96
127
129
136
171
EST g (0,15; 1)
EST e (0.04;1)
PO u (0)
FIN m…
FIN i (0.0; 1))
POLv (0.8; 0.86)
PO s (0.5; 1,00)
SE ab (0,79;…
PO v (0.56; 0.96)
DE o (0,44)
EST d (0,1; 1)
PO x (0.9; 0.98)
DE p (0.37; 0.84)
EST f 0.44; 0.98)
FIN h (0,8; 0.59)
PO t (0.43; 0.59)
FIN k (0.38;…
LAT ae (0.8; 1)
FIN j (0,63; 0.37)
PO r (0,57; 0,95)
DE b (0.16; 0.91)
SE z (0.93; 0.69)
SE ad (1.0; 0.72)
SE ac (1.03;…
DE c (0.49; 0.78)
DE a 1.12; 0.91)
SE y (1.03; 0.63)
PO q (1,46; 0,26)
ERA and BIC farms


200
150
100
50
0
-50
N-surplus (kg/ha year)
0,00
0,20
0,40
0,60
0,80
1,00
1,20
1,40
1,60
Animal density (au/ha)


ERA
y = 137,79x + 29,215
R² = 0,396
200
150
100
50
0
-50
N-surplus (kg/ha and year)
0,00
0,20
0,40
0,60
0,80
Fodder rate (external/used fodder N)

VAC1

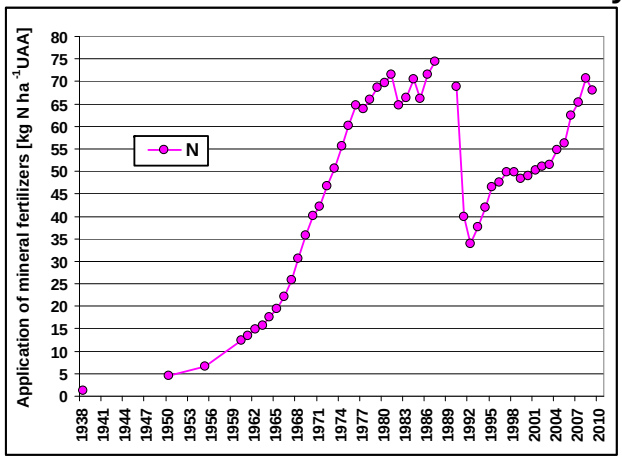
...ree scenarios for avarage field surplus of nitrogen from a
in the Baltic Sea region, based on the BERAS studi

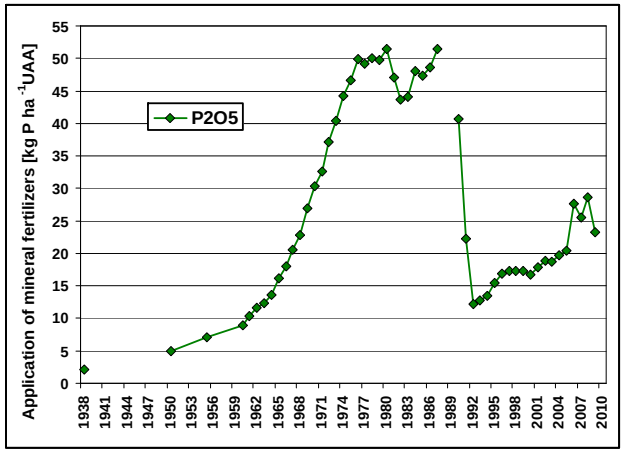


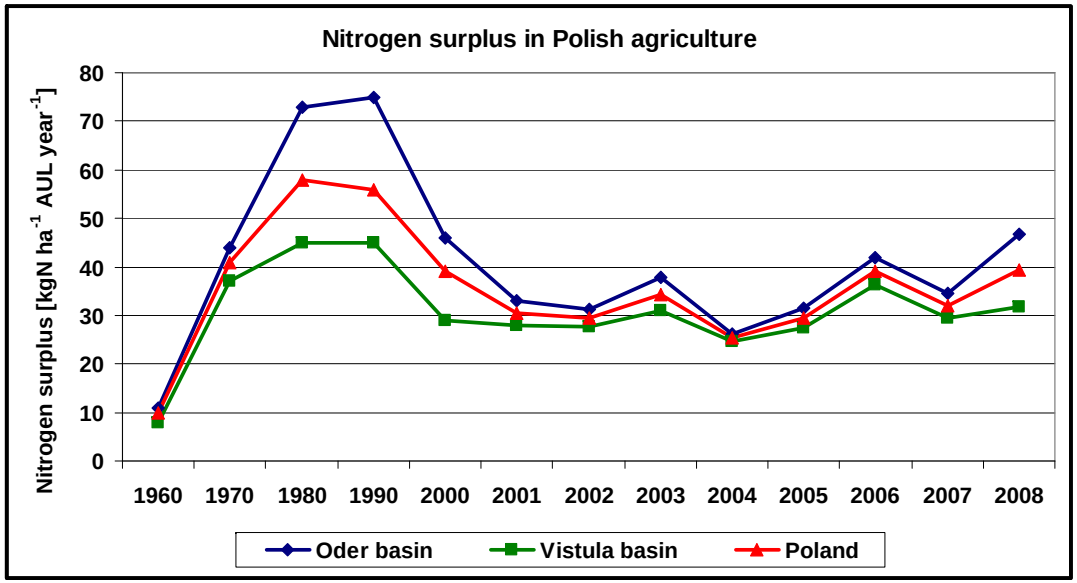
Dia 22

VAC1 Valued Acer Customer; 26.8.2013

National Marine Fisheries Research Institute
Department of Fisheries Oceanography and Marine Ecology
Gdynia, Poland



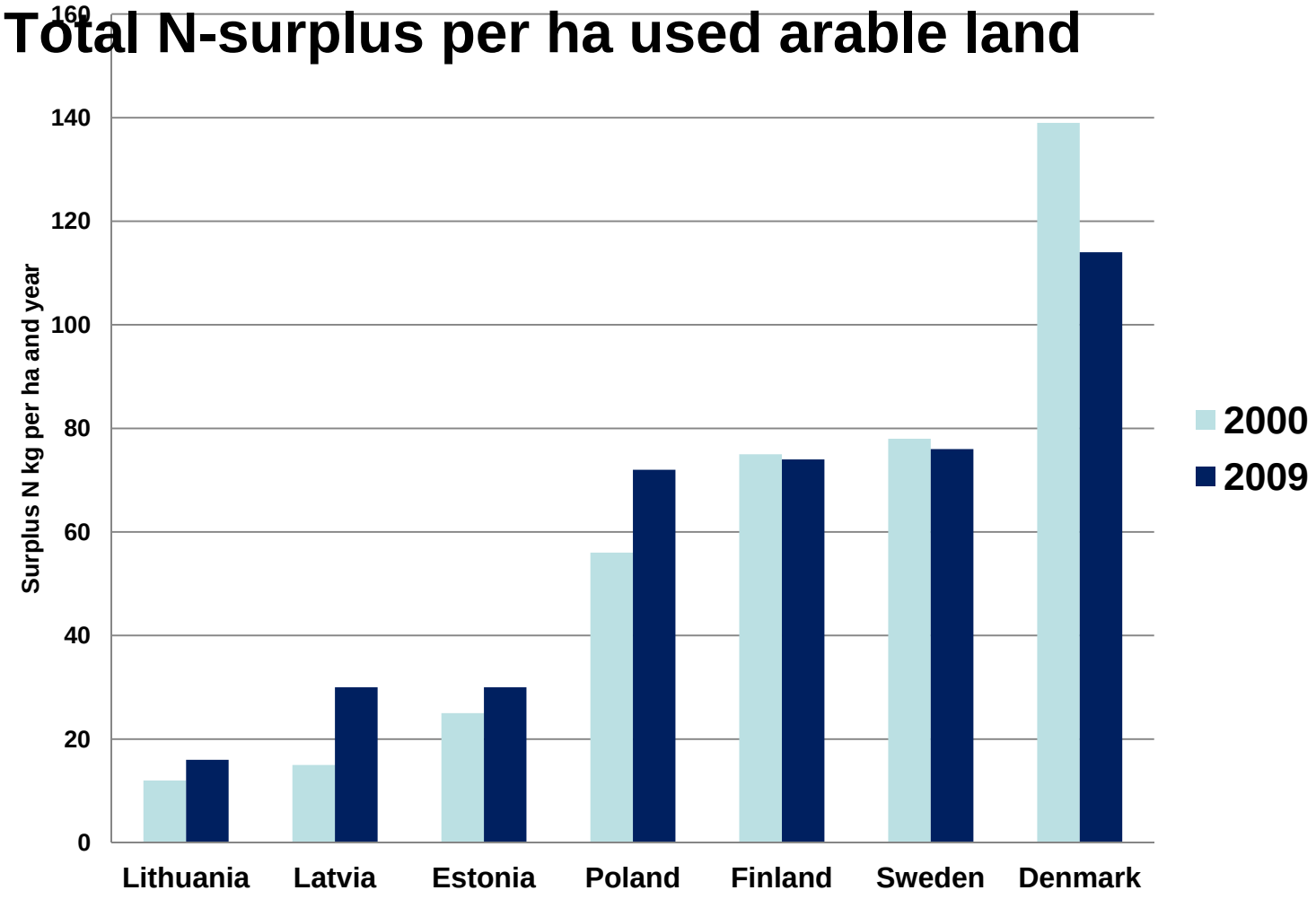


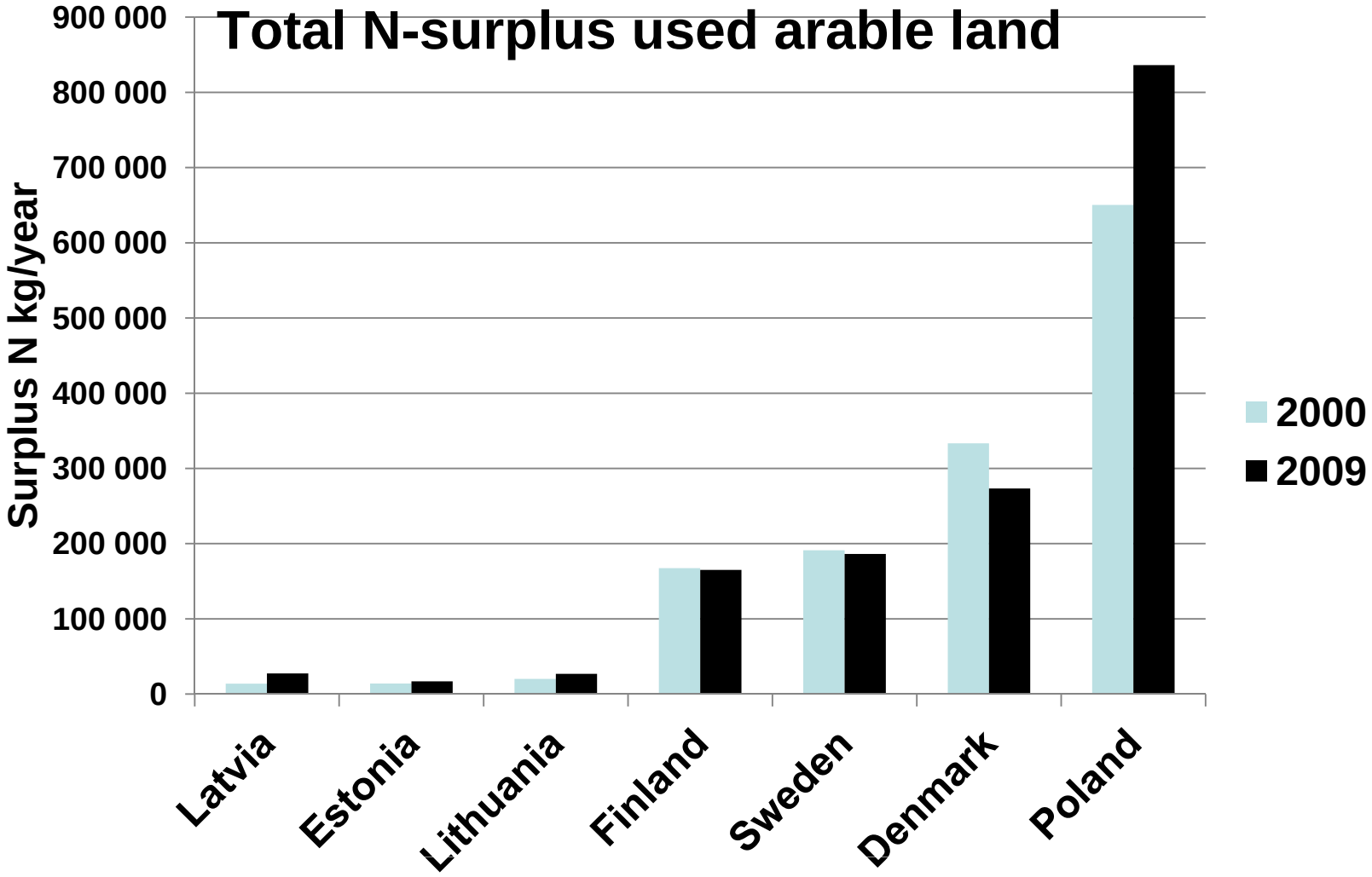


Prof. dr Marianna Pastuszak,

2013-09-01

Total N-surplus per ha used arable land




Total N-surplus used arable land
Surplus N kg/year
900 000
800 000
700 000
600 000
500 000
400 000
300 000
200 000
100 000
0
Latvia
Estonia
Lithuania
Finland
Sweden
Denmark
Poland
2000
2009

- **The ecological recycling agriculture based on integrated crop and animal production with effective recycling of nutrients and organic biomass and crop rotation with legume - grassland is the necessary way to:**
- **1. Protect the Sea from surplus leaching of reactive Nitrogen and Phosphorus**
- **2. Protect the environment from pesticides**
- **3. Conserve basic natural resources**

and also

4. Rebuild fertile soils

5. Reduce global emissions of green house gases

Understand the reason why to high surplus and losses from agriculture and the possible solutions

A common agricultural conversion program to realize ecological recycling agriculture based on renewable resources