



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

Spatial delineation of cropping systems

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Combined types of crops derived from monitoring data

Objectives

- ** to improve data input to agro-economic models
 - * to regionally stratify the cropland area (rainfed arable land)
 - * to detect cropping pattern, to refine the mapping of crops (against CORINE using Lucas)

Combined types of crops derived from monitoring data

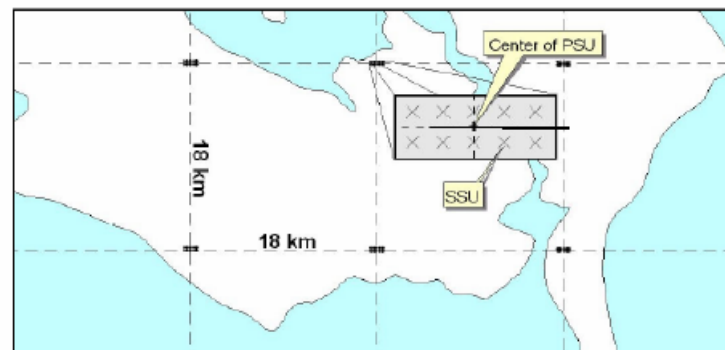
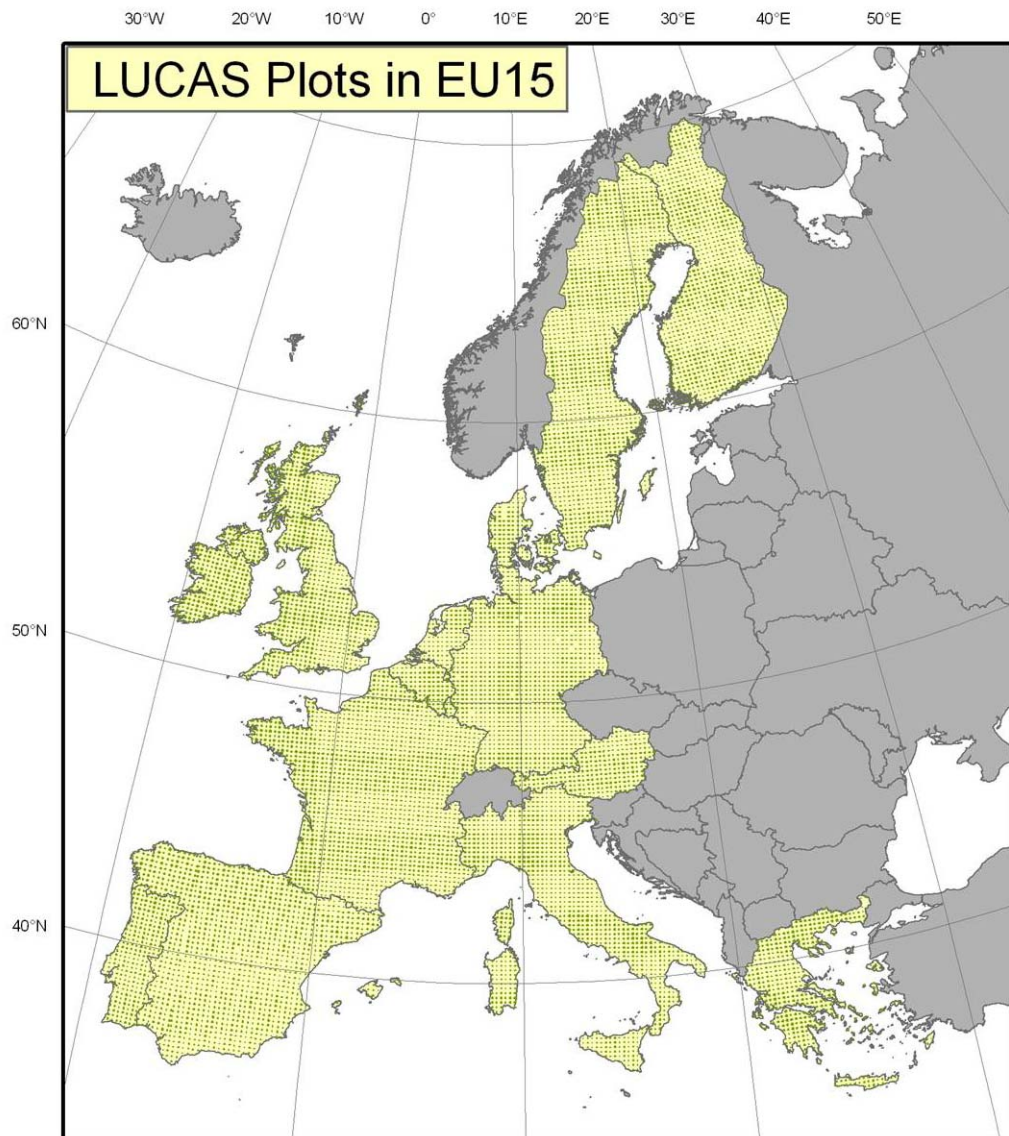
Rationale

- * Land use systems are mostly controlled by management
- * Land use systems are temporal and spatial systems
- * Relation between number of crops and yield exists
- * Crop shares mainly depend on climatic conditions

Combined types of crops derived from monitoring data

Data basis

LUCAS phase 1 EU15, 2003

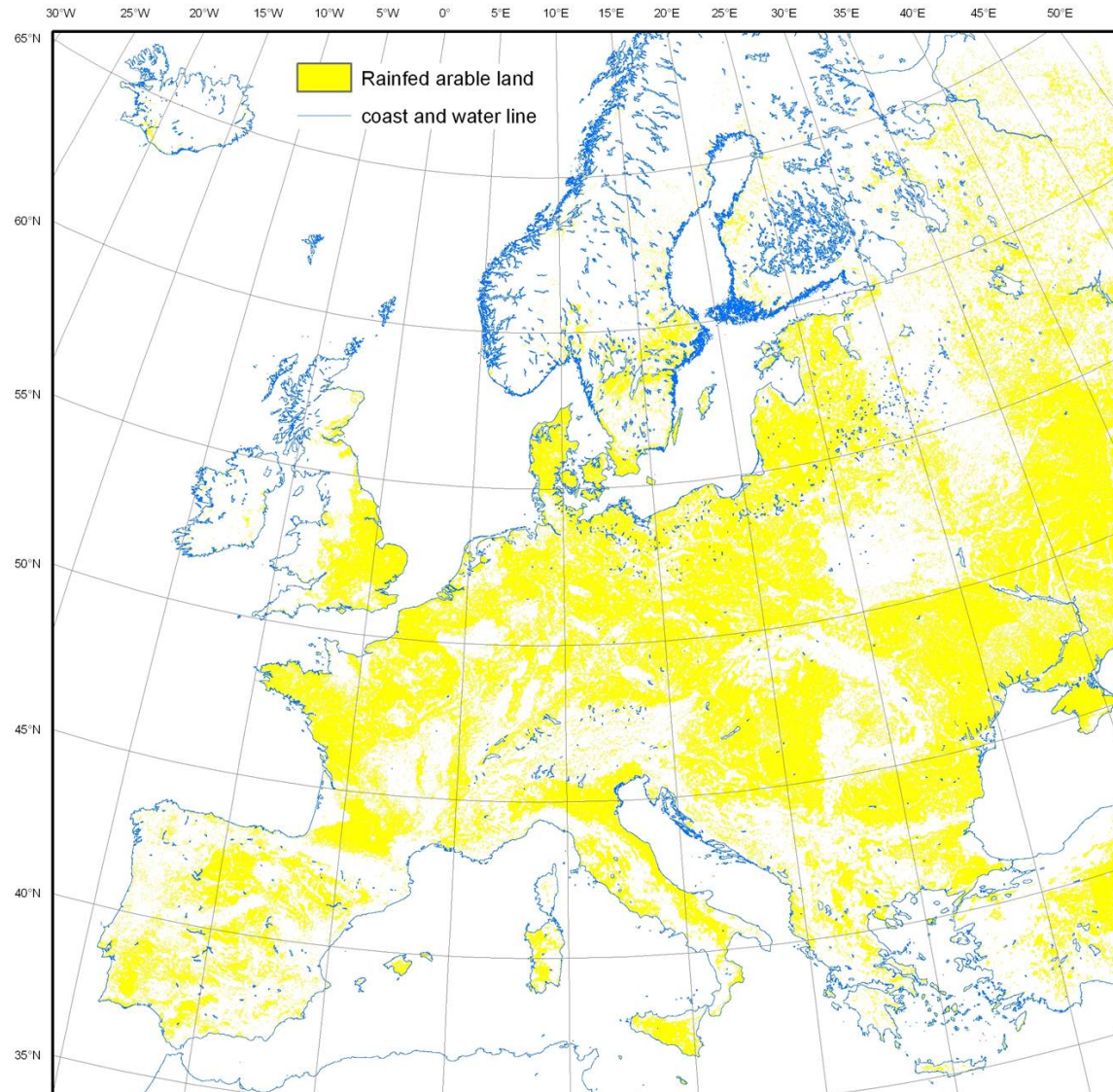


Country		Number of PSU	Number of SSU
Austria	AT	255	2528
Belgium	BE	100	989
Germany	DE	1105	10981
Denmark	DK	147	1373
Spain	ES	1268	12670
Finland	FI	1073	10410
France	FR	1702	16916
Greece	GR	419	4051
Ireland	IE	218	2163
Italy	IT	941	9275
Luxembourg	LU	8	80
The Netherlands	NL	117	1154
Portugal	PT	277	2731
Sweden	SE	1407	13808
United Kingdom	UK	775	7499
EU15		9812	96633

Combined types of crops derived from monitoring data

Data basis

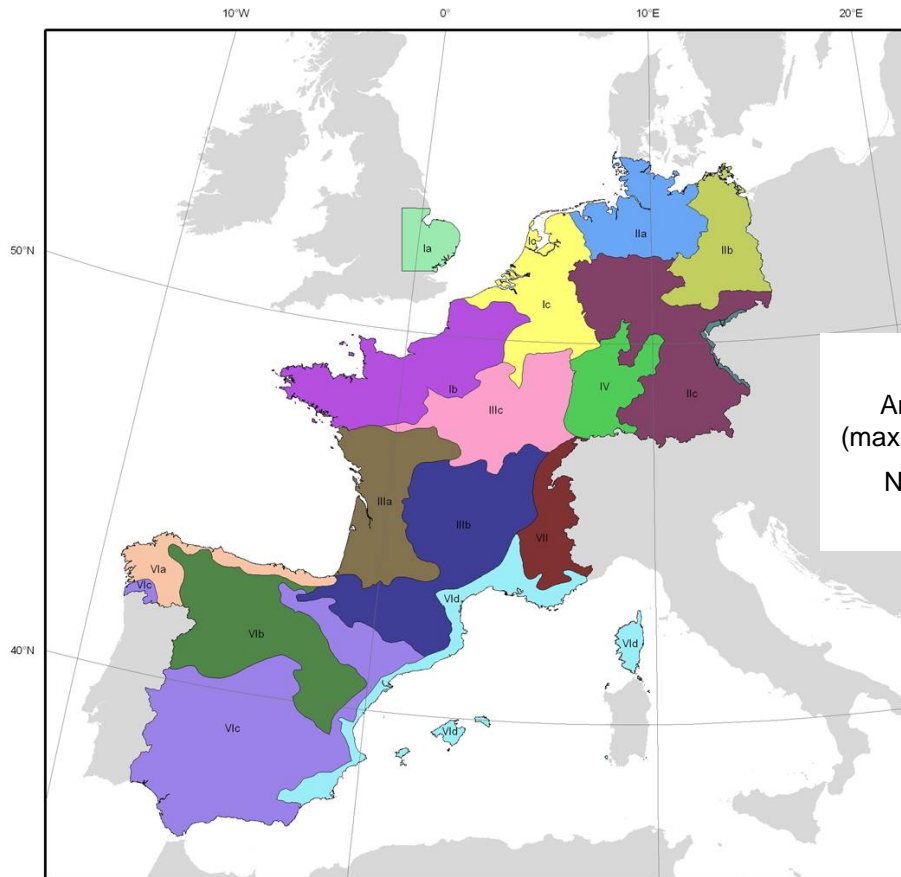
PELCOM, 2000



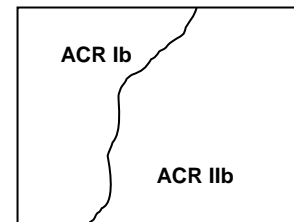
Combined types of crops derived from monitoring data

Data basis

Agro Climatic Regions (SCHULZKE et al. 1998)



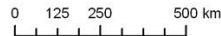
Mean of monthly temperature
 Annual precipitation and distribution
 (maximum of precipitation, dry periods)
 Number of sunshine hours per year
 Elevation in meter above NN



Combination of these properties results in:
Agro-climatic regions (1 : 1 Mil - 1 : 10 Mil)

Agro Climatic Region (ACR) [% of rainfed arable land in ACR]

- | | |
|---|--|
| Ia - East England [97] | IIIc - North-Eastern France [65] |
| Ib - Northern France [80] | IV - Vosges Region [57] |
| Ic - Netherlands, East of Ile de France, Western Ems [55] | V - Erz-, Fichtelgebirge, Bavarian Forest [23] |
| IIa - North-Western German Lowlands [73] | VIa - Galicia, Asturia [15] |
| IIb - North-Eastern German Lowlands [79] | VIb - Leon, Old-Castilia, Iberian Mountains [40] |
| IIc - Middle and South German Hill-Countries [78] | VIc - New-Castilia, Estromadura, La Mancha, Andalusia [34] |
| IIIa - Western France [77] | VIId - Stretch of coast from Cartagena to Barcelona [19] |
| IIIb - Central Upland, Pyrenean [32] | VII - Eastern France [24] |



Combined types of crops derived from monitoring data

Methods

Spatial neighbourhood is interpreted as temporal succession

Statistical evaluations + GIS

- Configuration frequency analysis
- Point density
- Spatial Correlation
- Principal component analysis

Validation

Comparison between statistical units NUTSII and point density results

Interpretation

Expert supported interpretation of factors in defined areas

Combined types of crops derived from monitoring data

Interim results I

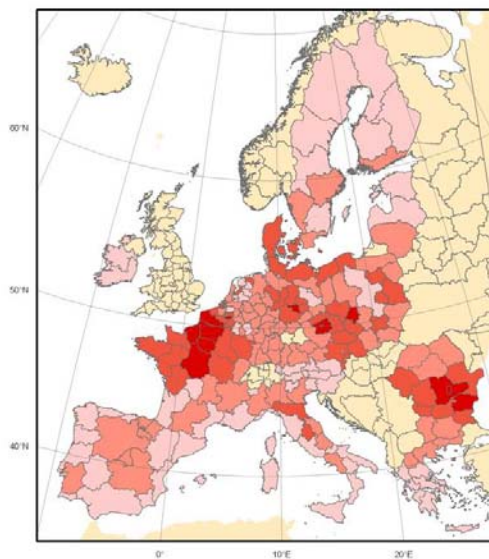
Rank	LUCAS symbol	Crop species
1	B11	Common wheat
2	B16	Maize
3	B13	Barley
4	B12	Durum wheat
5	B32	Rape seeds
6	B22	Sugar beet
7	B50	Temporary artificial pasture
8	B60	Fallow land
9	B31	Sunflower
10	B41	Dry pulses
11	B43	Other fresh vegetables
12	B14	Rye
13	B21	Potatoes
14	B33	Soya
15	B35	Other fibre and oleaginous crops
16	B15	Oats
17	B18	Other cereals
18	B23	Other root crops
19	B37	Other non perm. indust. crops
20	B83	Nurseries (+ fruit tree plantations)

Statistical significance ($\alpha=0,1\%$) between:

- LUCAS crops, and
- PELCOM „rainfed arable land“

Combined types of crops derived from monitoring data

Interim results II

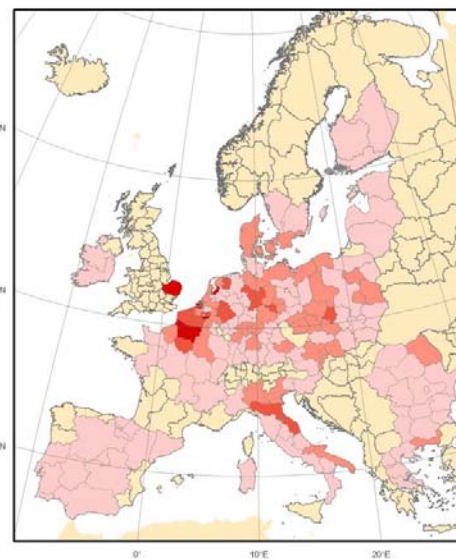


Comparison between administrative units and monitor territory

Center of common wheat cultivation by statistical units

Common Wheat density in NUTSII
[min 0,001 % NUTSII area]
[max 27.2 % NUTSII area]

- 10 (< 2,7 % NUTSII area)
- 33 (< 9,0 % NUTSII area)
- 66 (< 18,0 % NUTSII area)
- 100 (< 27,2 % NUTSII area)
- missing values or out of scope

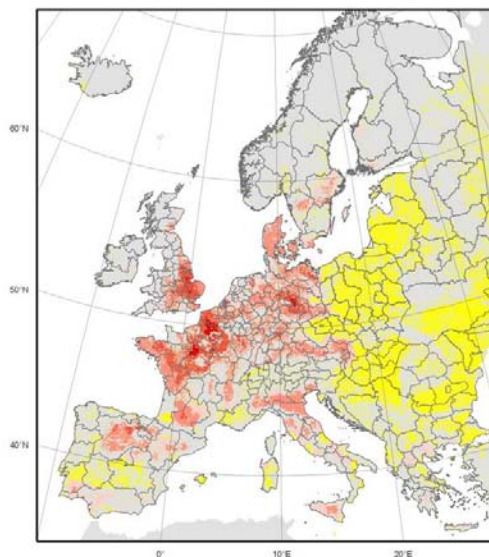


Comparison between administrative units and monitor territory

Center of sugar beet cultivation by statistical units

sugar beet density in NUTSII
[min 0,003 % NUTSII area]
[max 11 % NUTSII area]

- 10 (< 1,1 % NUTSII area)
- 33 (< 3,8 % NUTSII area)
- 66 (< 7,6 % NUTSII area)
- 100 (< 11,6 % NUTSII area)
- missing values or out of scope



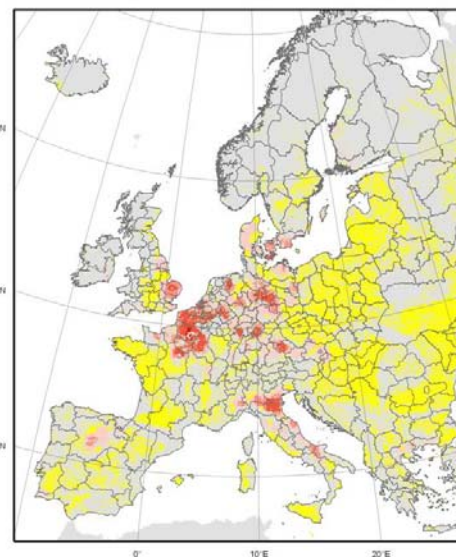
Center of common wheat cultivation by monitor territory

LUCAS Inventory density [%]

- 10
- 33
- 66
- 100
- other rainfed arable land (in investigation area and out of scope area)
- out of scope

Source:
- EuroStat, Luxembourg; 2004
- LUCAS 2003

0 250 500 1,000 km



Center of sugar beet cultivation by monitor territory

LUCAS Inventory density [%]

- 10
- 33
- 66
- 100
- other rainfed arable land (in investigation area and out of scope area)
- out of scope

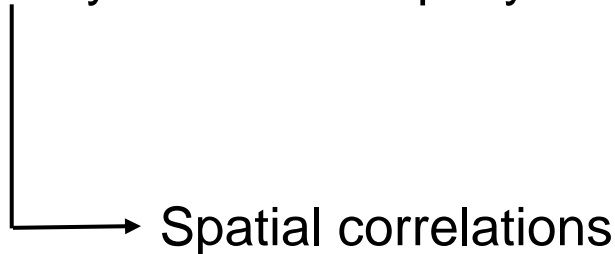
Source:
- EuroStat, Luxembourg; 2004
- LUCAS 2003

0 250 500 1,000 km

Combined types of crops derived from monitoring data

Interim results III

Overlay between crop layers



crop	b13	b14	b15	b16	b18	b21	b22	b32	b35	b41	b43	b50	b60	b83
b11	0,06	-0,24	-0,11	-0,40	0,33	-0,22	0,43	0,27	-0,23	-0,09	-0,32	-0,08	0,12	0,36
b13		0,16	0,05	0,14	0,07	-0,04	-0,07	0,11	-0,19	0,02	0,22	-0,17	0,26	0,20
b14			0,09	0,26	-0,25	-0,06	-0,17	-0,04	-0,31	-0,37	0,39	-0,02	0,26	0,53
b15				-0,06	-0,22	-0,17	-0,03	0,25	0,00	-0,04	0,16	0,08	-0,06	0,16
b16					-0,19	0,24	-0,26	-0,26	-0,27	0,01	0,36	-0,07	0,06	-0,40
b18						0,08	0,32	-0,30	-0,15	-0,04	-0,21	-0,34	0,23	0,00
b21							0,43	-0,47	0,66	-0,24	-0,25	-0,35	-0,04	-0,83
b22								-0,35	0,64	0,14	-0,60	-0,31	0,32	-0,43
b32									-0,54	-0,02	0,22	0,30	-0,31	0,61
b35										0,00	0,00	0,07	-0,23	0,00
b41											-0,12	0,31	-0,22	0,00
b43												0,23	-0,17	0,00
b50														-0,01
b60														0,00

Example:
North-western German
lowlands (ACR IIa)

crop	Faktor 1	Faktor 2	Faktor 3	Faktor 4	Faktor 5	Faktor 6
b11	0,01	0,85	-0,03	-0,12	0,23	0,53
b13	-0,10	0,05	-0,40	0,61	0,33	0,37
b14	-0,21	-0,26	-0,52	-0,02	-0,46	0,32
b15	-0,15	-0,05	0,08	0,38	0,68	-0,66
b16	-0,01	-0,72	-0,31	0,08	0,08	0,27
b18	0,20	0,49	-0,24	-0,07	-0,06	-0,88
b21	0,43	-0,42	-0,04	-0,13	0,33	0,33
b22	0,43	0,39	0,05	0,28	0,05	0,38
b32	-0,40	0,32	0,18	-0,12	0,54	0,41
b35	0,31	-0,17	0,38	0,18	-0,24	-0,05
b41	-0,01	0,07	0,44	0,64	-0,37	0,01
b43	-0,28	-0,57	-0,10	0,07	0,08	-0,29
b50	-0,22	-0,19	0,55	0,06	-0,23	0,35
b60	0,12	0,24	-0,64	0,23	-0,19	0,06
b83	-0,37	0,54	-0,09	0,08	-0,43	-0,10

Combined types of crops derived from monitoring data

Results – crop combinations

<i>Eigen-value</i>	<i>Crop combinations</i>	<i>Generalized pattern</i>
22	Potatoes – Sugar beet	(II)
16	Common wheat – Sugar beet – Rape seeds	II
14	Temporary artificial pasture – Dry pulses	VIII
7	Dry pulses – Barley	III
6	Oats – Rape seeds	I
5	Other fibre and oleaginous crops – Rye – Rape seeds	I

Example:

North-western German lowlands (ACR IIa)

- each row represents a factor
- selection of crops per factor according to factor load and expert knowledge
- large proportion of rainfed arable land in each ACR can be described with crop combinations
- the approach is spatially-explicit

Combined types of crops derived from monitoring data

Results – generalized pattern of crop combinations

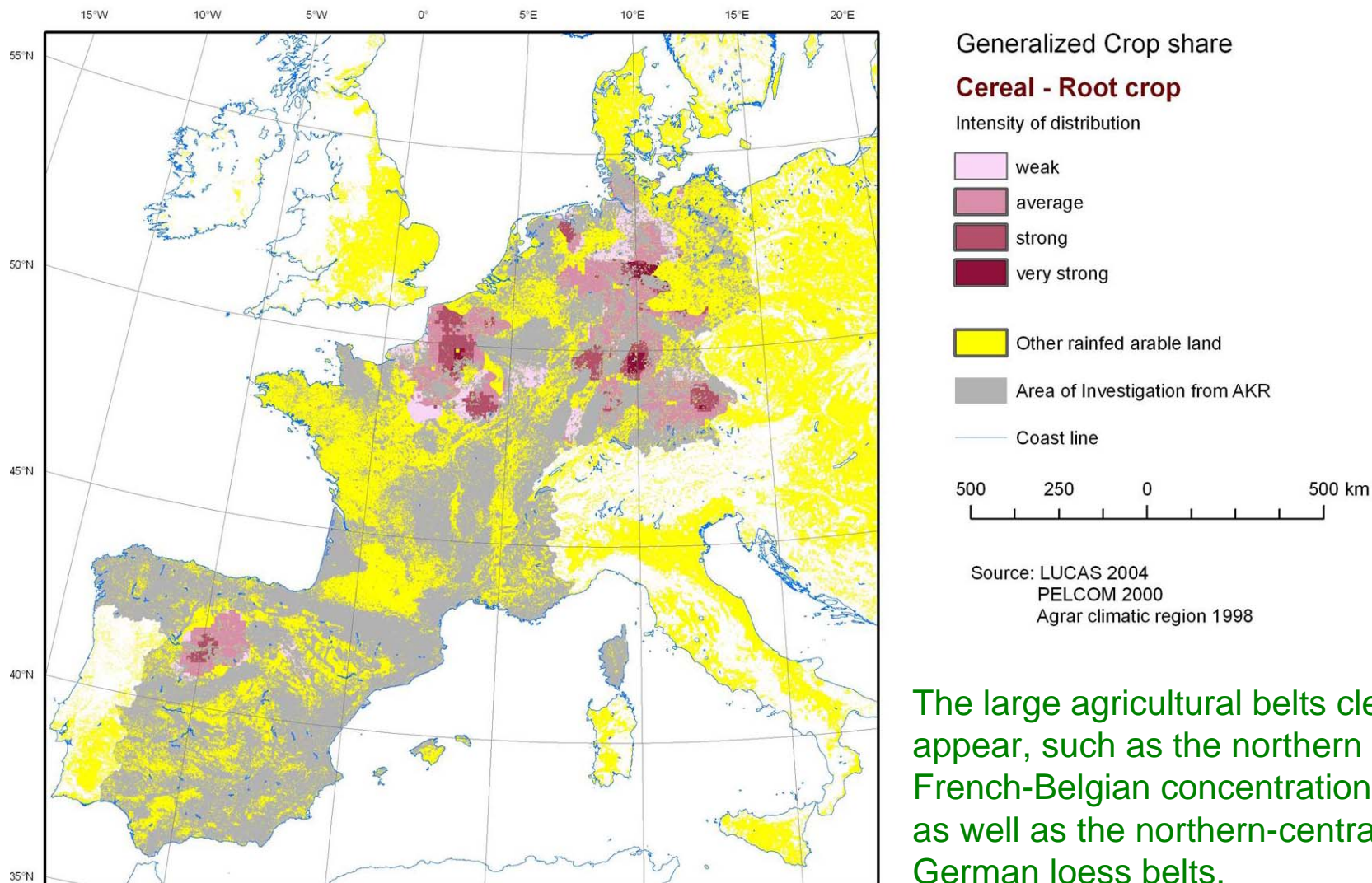
Pattern of „generic“ crop shares

- | | | | |
|-----|----------------------------|------|------------------------------------|
| I | - cereal – oleaginous crop | V | - monocultural (maize, sun flower) |
| II | - cereal – root crops | VI | - fallow land |
| III | - cereal – pulses | VII | - special crops |
| IV | - cereal economy | VIII | - fodder |

- certain crop combinations follow a generic pattern dominated by the most common crops in Europe
- generalisation allows the connectivity of the results beyond administrative boundaries (factors share a common scale)

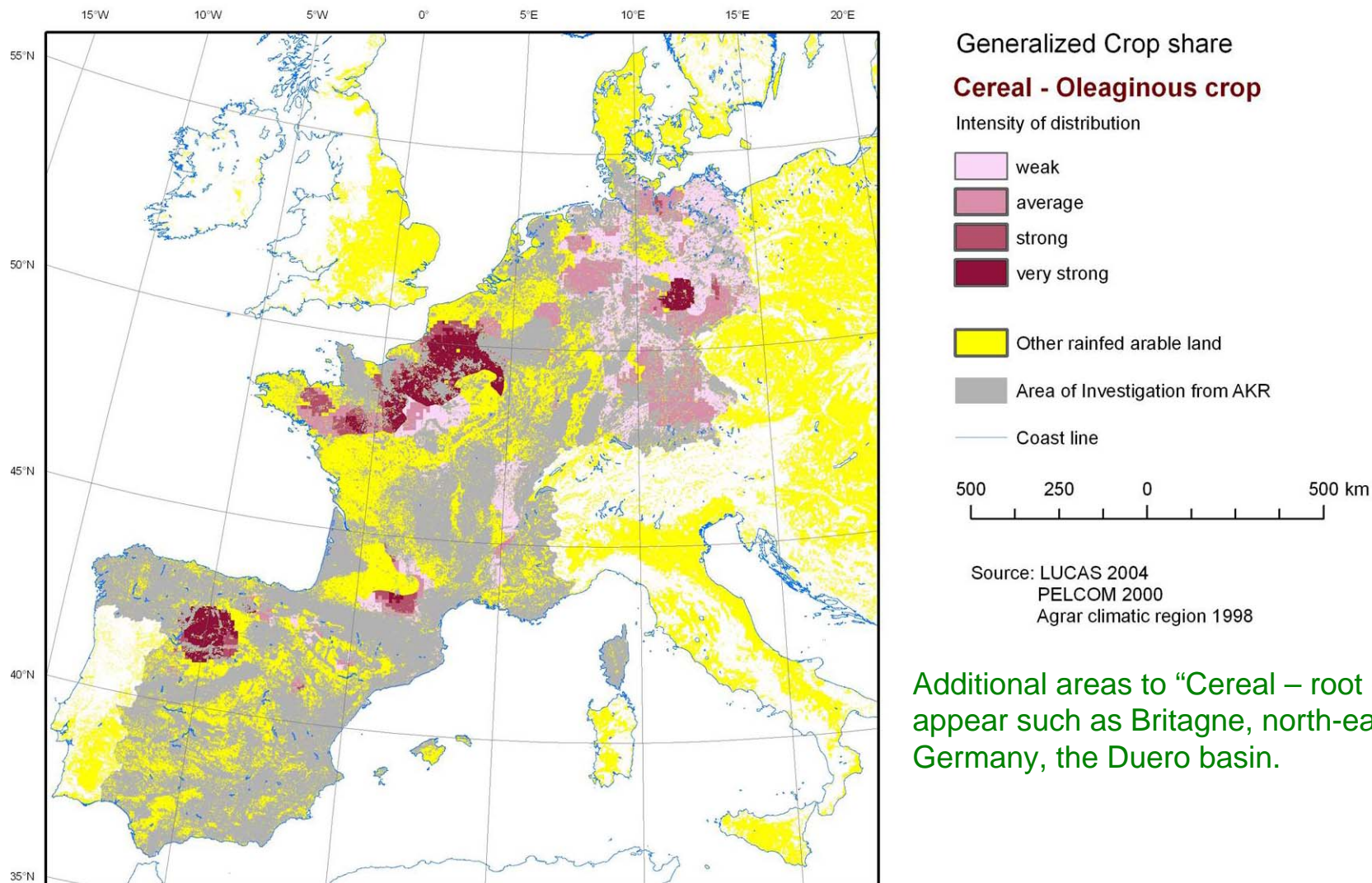
Combined types of crops derived from monitoring data

Results – Generic crop maps



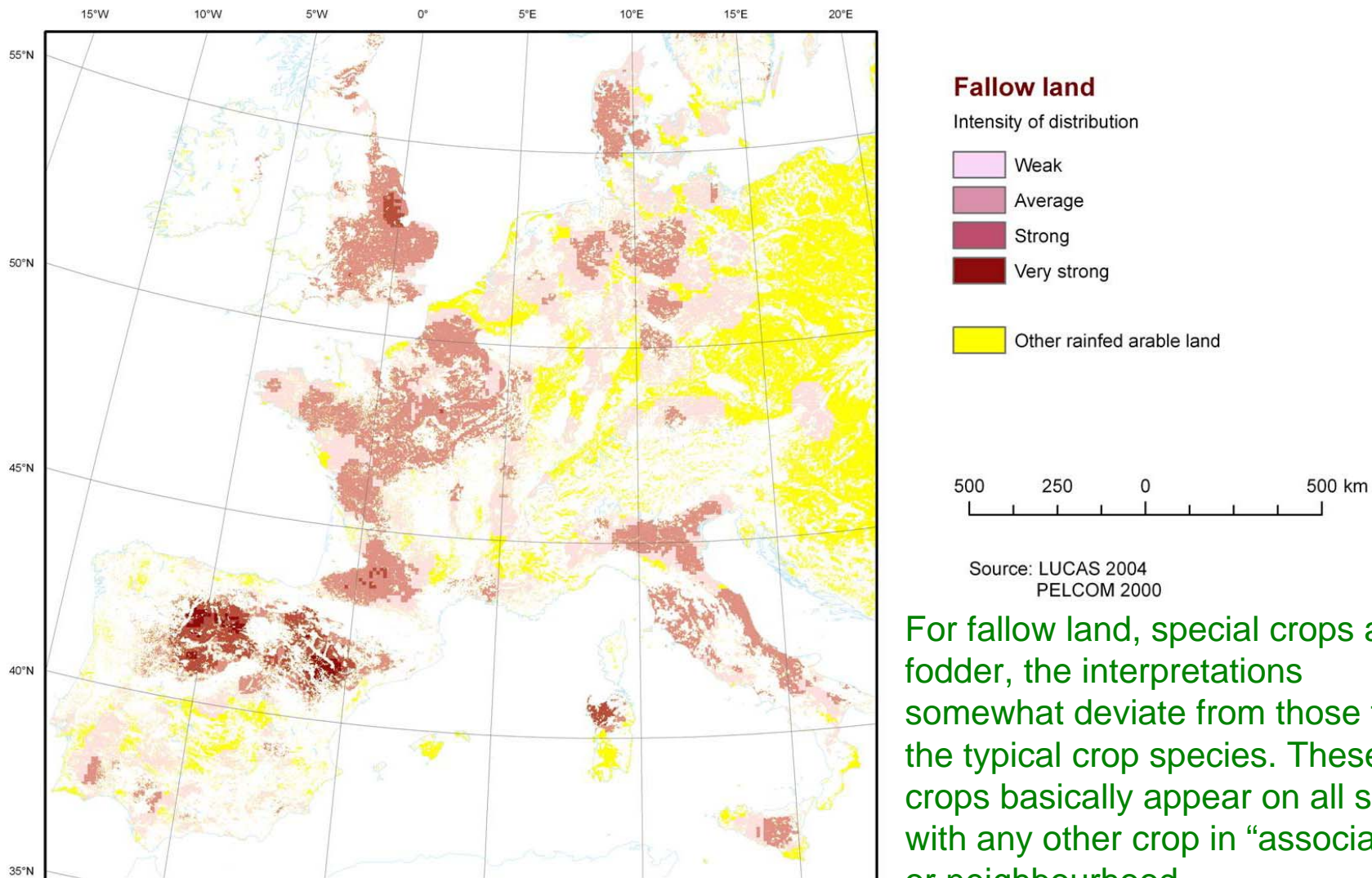
Combined types of crops derived from monitoring data

Results – Generic crop maps



Combined types of crops derived from monitoring data

Results distribution of fallow land in EU 15, intensity of abandoned farmland



For fallow land, special crops and fodder, the interpretations somewhat deviate from those for the typical crop species. These crops basically appear on all sites with any other crop in “association” or neighbourhood

Combined types of crops derived from monitoring data

Conclusions

- ✓ first approximation to the spatial mapping of crop species
- ✓ statistical methods combined with expert knowledge to derive regional combination of crops from neighbouring effects in the LUCAS data base
- ✓ crop combinations as crop rotations in the modelling require further validation
- ✓ further stratifications and LUCAS repetition would provide possibilities to substantially improve the reliability