

# Land market & Genedec

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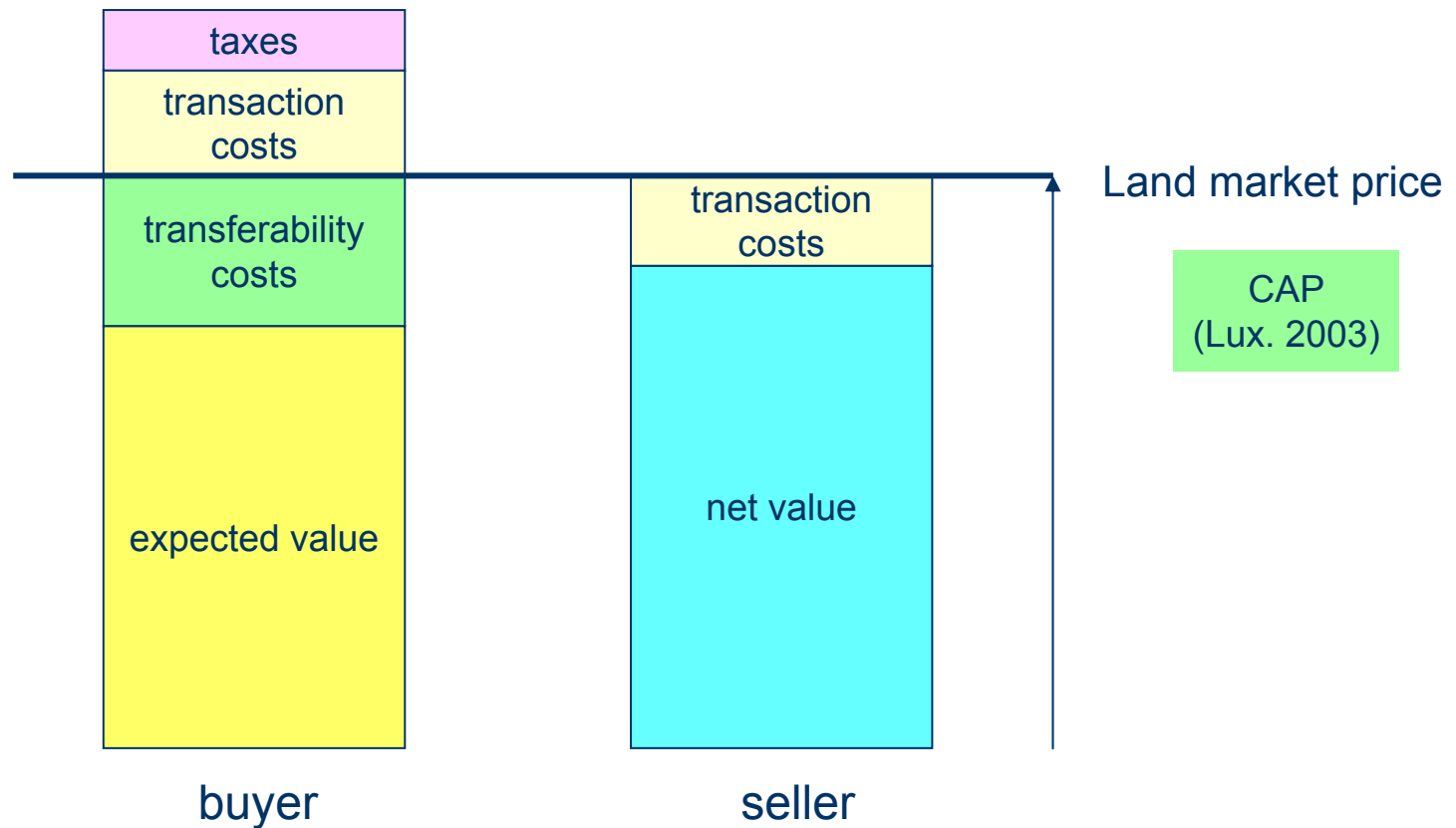
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# Overview

1. Land market, land prices, shadow prices of agricultural land
2. Change in CAP and change in shadow prices
3. Spatial range of shadow prices
4. Other elements implied in the change of the price

Stuff from : 

## Agricultural land market (generally submitted to destination restrictions)



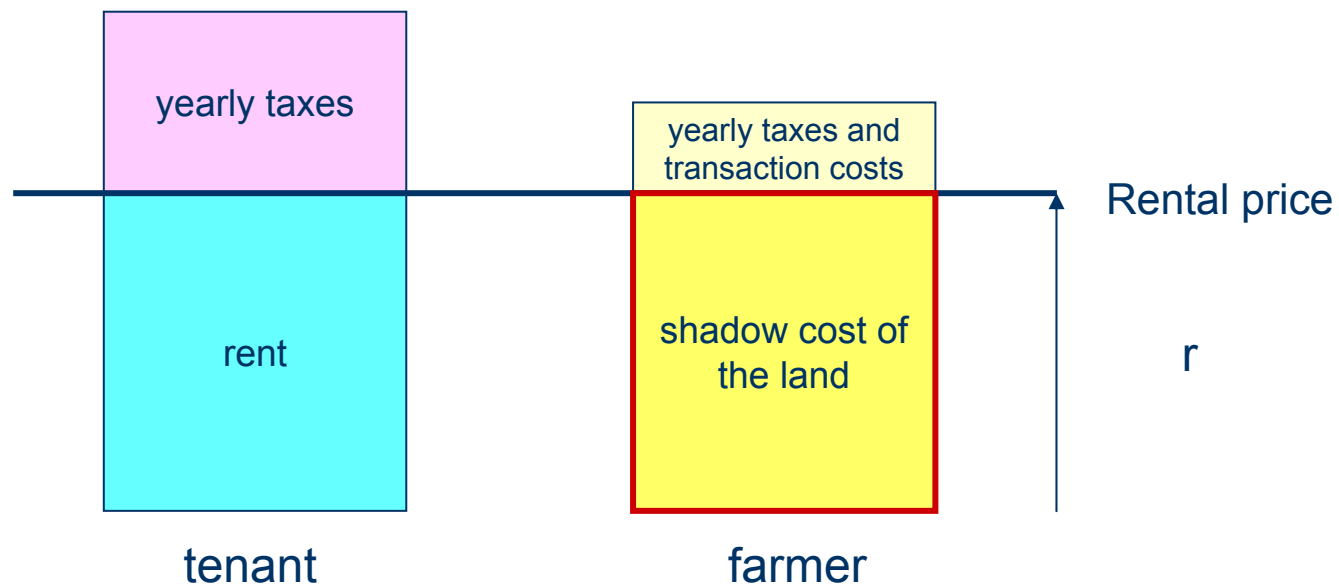
## Land price and (yearly) rental price

$$p = \lim_{T \rightarrow \infty} r \sum_{t=1, T} 1/(1+d)^t = r / d$$

p : price

r : rent

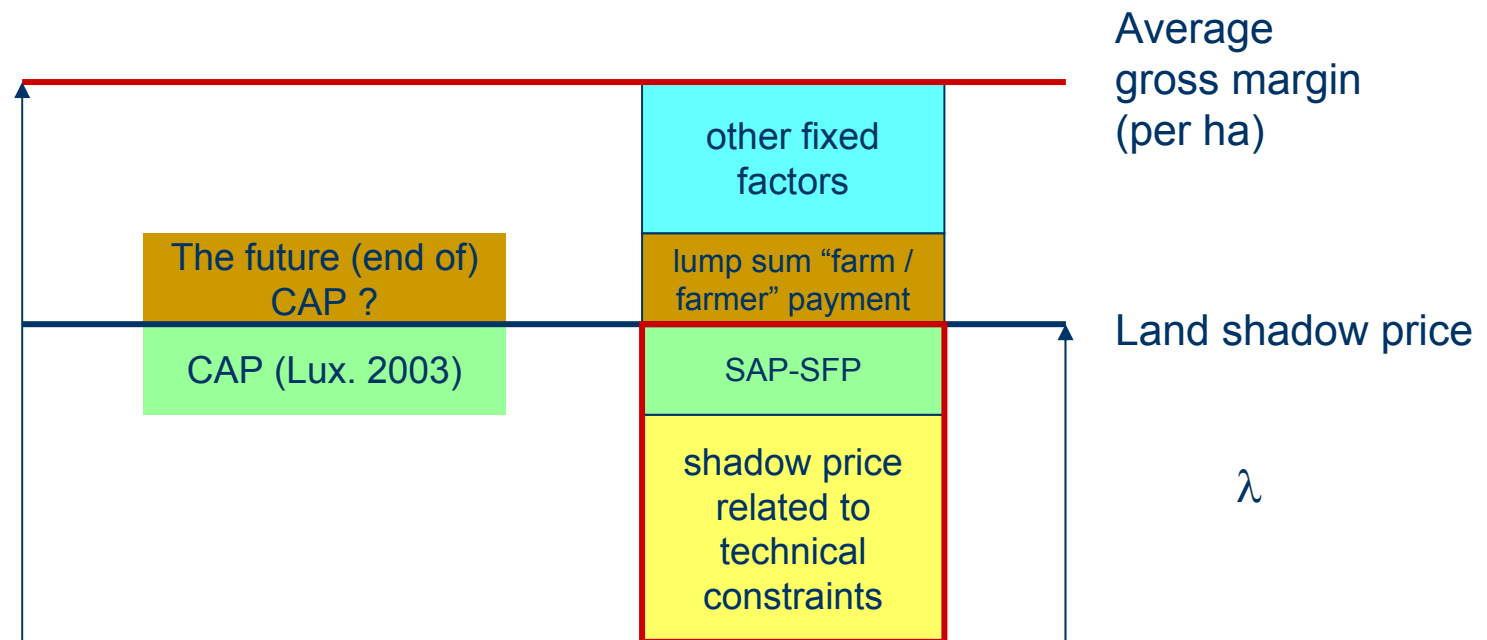
d : discount rate



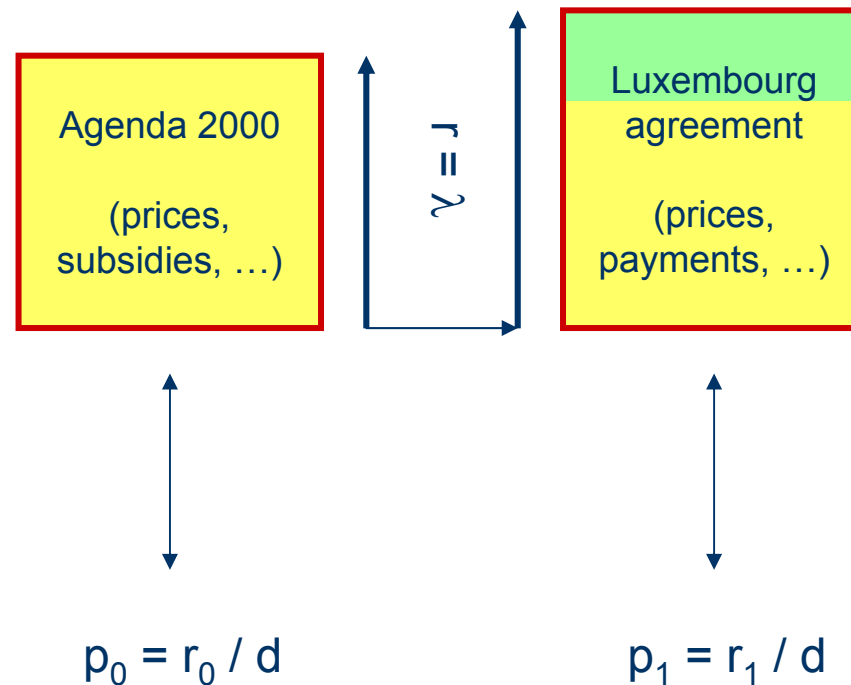
## Gross margin and shadow costs of fixed factors

*Duality theory :*

*optimal gross margin of the farm = sum of optimal marketed net-puts valued by market prices  
= sum of resources valued by optimal dual prices*



## From CAP change to land market



**Let us focus now on the shadow price  $\lambda$**

## Change in CAP

Some elements about the CAP change from the Agenda 2000 to the Luxembourg agreement :

- partial or total abolition of direct subsidies (partial mainly FR, ES, ...)
- single farm payment related to eligible areas (SAP-SFP)
- set-aside requirement maintained
- incentives for pastures through differentiated SAP (DE)
- farm level / regional level SAP-SFP
- historic / dynamic SAP-SFP

## CAP change in mathematical programming models

Additional sub-matrix  
related to Lux2003  
in the AROPAj model  
(see Genedec – D4)

Set-aside  
Pastures (related to technical modules)  
Non subsidied set-aside  
Subsidied areas except pasture and set-aside  
Subsidies pasture (DE)  
Binary variable  
Binary variable  
pseudo « right hand side »

set-aside payment

other area payment

differentiated area  
payment (DE)

|                  | $X_{nsa}$ | $X_{pas}$ | $X_{sgdl}$ | $X_{rgdl}$  | $X_{pgdl}$  | $I_{gdlg}$ | $I_{gdh}$ | ZF      |          |
|------------------|-----------|-----------|------------|-------------|-------------|------------|-----------|---------|----------|
| OBJ              | psgel     |           |            | psngl+psrta | psngl+psrpa |            |           |         |          |
| GDL <sub>1</sub> | -1        |           |            |             |             | refarea    |           |         | $\leq 0$ |
| GDL <sub>2</sub> |           |           | 1          |             |             |            | -99999    |         | $\leq 0$ |
| GDL <sub>3</sub> |           |           |            | 1           | 1           | -99999     |           |         | $\leq 0$ |
| GDL <sub>4</sub> | 1         |           |            |             |             |            |           | -reffin | $\leq 0$ |
| GDL <sub>5</sub> | 1         |           | 1          | 1           | 1           |            |           | -SAU    | $\leq 0$ |
| GDL <sub>6</sub> |           | -1        |            |             | 1           |            |           |         | $\leq 0$ |
| GDU              |           |           |            |             |             | 1          | 1         |         | $= 1$    |

## Shadow prices, rental values, land rental market

- MIP-LP (i.e. AROPAj):
  - o Dual values of land equation are used as indicator for rental land values;  
Transfer of land between farm groups not considered (but could be).
  
- PMP:
  - o Dual values of land equation are used as indicator for rental land values (i.e. PROMAPA.G)
  - o Equilibrium rental prices derived from land-exchange equation between farm groups are used (EU-FARMIS)

## The shadow price related to the land (LP)

Let us assume that  $SAU$  is the total eligible area.

Let us consider the envelope of the different decoupling policies.

The farmer's programme could be summarized by:

$$\begin{array}{llll} \max_{x,s} & q \cdot x - c \cdot s + d \text{ SAU} & (+ F) & \text{(lump sum transfer F)} \\ \text{s.t.} & \sum_{j=1,J} s_j \leq SAU & (\sigma) & \text{« land resource »} \\ & \sum_{k=1,K} x_k \leq SAU & (\tau) & \text{« CAP constraint GDL5 »} \\ & \text{other constraints} & & \end{array}$$

Generally (taking account the binding status of constraints, the mix-variable problem), the envelope theorem leads us to :

$$\lambda = \sigma + \tau + d$$

## Average MS shadow prices (AROPaj)

| MS   | Gross margin |      |      | Subsidies |      |      | Shadow price of land |      |      |
|------|--------------|------|------|-----------|------|------|----------------------|------|------|
|      | AG15         | LX15 | FD15 | AG15      | LX15 | FD15 | AG15                 | LX15 | FD15 |
| belg | 641          | 648  | 670  | 288       | 288  | 299  | 932                  | 1011 | 1060 |
| dani | 810          | 813  | 833  | 320       | 320  | 322  | 782                  | 868  | 859  |
| deut | 1126         | 1189 | 1148 | 321       | 373  | 320  | 762                  | 922  | 852  |
| ella | 2136         | 2111 | 2113 | 655       | 614  | 614  | 1180                 | 1526 | 1538 |
| espa | 615          | 613  | 628  | 306       | 299  | 303  | 632                  | 672  | 734  |
| fran | 801          | 801  | 833  | 324       | 313  | 326  | 621                  | 673  | 752  |
| gbre | 781          | 794  | 802  | 265       | 265  | 265  | 569                  | 748  | 734  |
| irla | 647          | 651  | 653  | 294       | 284  | 284  | 554                  | 656  | 637  |
| ital | 2349         | 2359 | 2370 | 357       | 355  | 355  | 792                  | 883  | 884  |
| luxe | 958          | 985  | 999  | 270       | 272  | 272  | 492                  | 623  | 628  |
| nede | 3748         | 3764 | 3768 | 297       | 296  | 297  | 3677                 | 3805 | 3606 |
| osto | 1001         | 1012 | 1025 | 324       | 323  | 325  | 741                  | 782  | 856  |
| port | 890          | 905  | 927  | 249       | 245  | 248  | 735                  | 817  | 854  |
| suom | 840          | 840  | 845  | 204       | 199  | 199  | 398                  | 480  | 493  |
| sver | 766          | 778  | 789  | 225       | 222  | 221  | 479                  | 551  | 557  |
| EU15 | 1025         | 1039 | 1047 | 311       | 315  | 310  | 712                  | 811  | 827  |

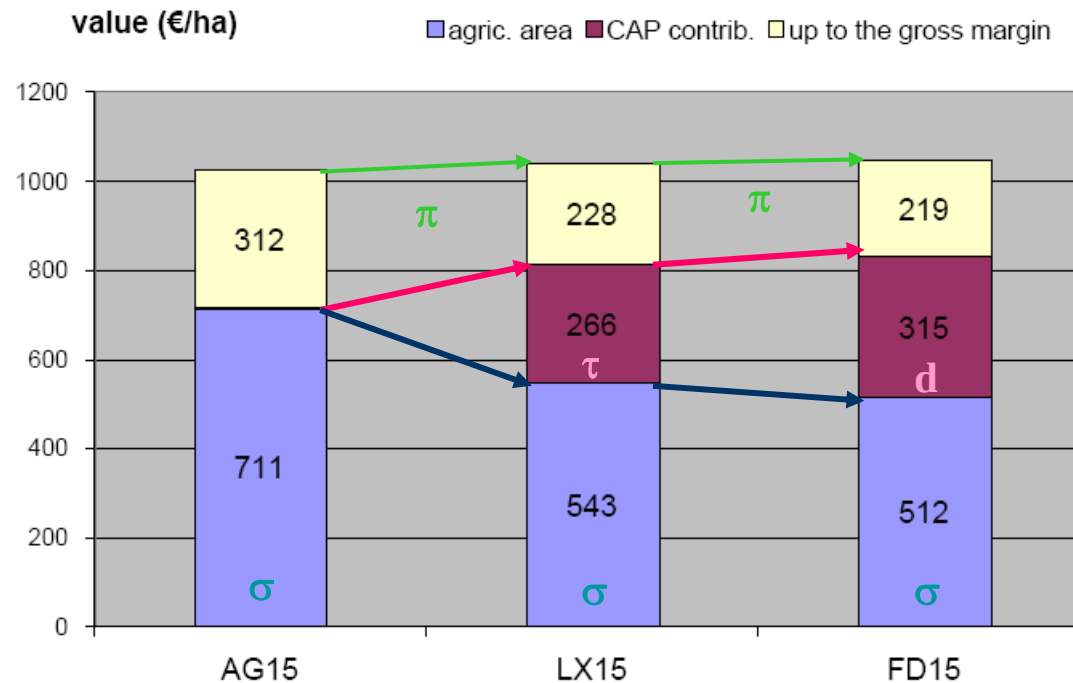
Comparison between gross margin per ha, subsidy per ha and shadow price of land for the 3 CAP scenarios (€/ha) : “Agenda 2000” (AG15), “Luxembourg agreement” (LX15) and “full decoupling” (FD15).

In the 3 scenarios, livestock adjustment is allowed and limited to a range of +/-15%.

| MS   | LX15 |           | FD15 |         |
|------|------|-----------|------|---------|
|      | land | set-aside | land | subsidy |
| belg | 812  | 198       | 761  | 299     |
| dani | 545  | 323       | 537  | 322     |
| deut | 540  | 382       | 532  | 320     |
| ella | 902  | 623       | 924  | 614     |
| espa | 489  | 184       | 431  | 303     |
| fran | 470  | 203       | 426  | 326     |
| gbre | 482  | 265       | 469  | 265     |
| irla | 373  | 283       | 353  | 284     |
| ital | 521  | 362       | 529  | 355     |
| luxe | 351  | 272       | 356  | 272     |
| nede | 3522 | 283       | 3309 | 297     |
| osto | 533  | 249       | 531  | 325     |
| port | 657  | 160       | 606  | 248     |
| suom | 261  | 203       | 294  | 199     |
| sver | 328  | 223       | 336  | 221     |
| UE15 | 548  | 267       | 517  | 310     |

Contribution of the land allocation constraint and the set-aside constraint (Luxembourg agreement) or the single area payment (full decoupling) to the shadow price of land (€/ha).

## Average EU-15 shadow price (AROPAj)



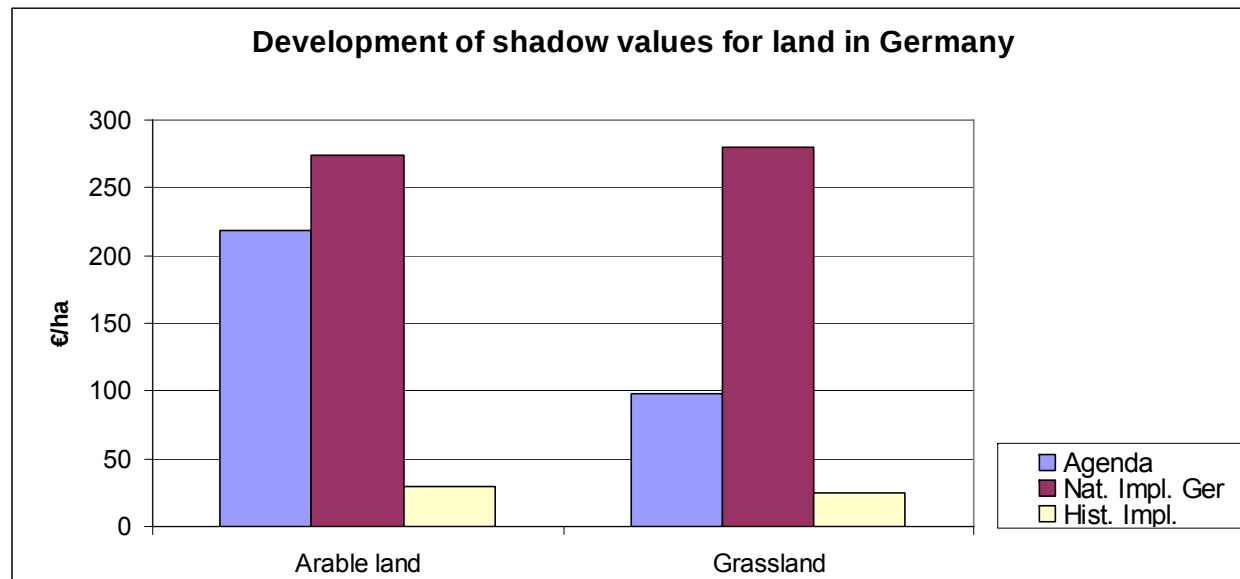
Contribution of the surface constraint and the CAP rules explicitly linked with the total land area at the farmer's disposal to gross margin  
(results provided by the AROPAj model for 3 CAP options; 28 farm-groups for which GAMS does not provide the dual solution are excluded from the estimate.)

## Average EU-15 shadow price (AROPAj)

Change in gross margin and shadow price when CAP changes:

- Global internal profitability (max gross margin when support is maintained subject to less constraints) => increasing gross margin  
=> increasing value of binding resources (i.e. land) ( $\pi$ )
- Support moving from a large range of direct subsidies (crops AND animals) toward the land mainly => increasing value of the land (s.t. eligibility) ( $\sigma + \tau + d$ )
- In the same time the value only related to the land resource except the CAP payment is decreasing ( $\sigma$ )

## EU-FARMIS (1)



### National Implementation in Germany

- Unified premiums levels in each region
- Premium captured in shadow values
- shadow values increase – especially for grassland

### Historical Implementation

- Farm individual premium levels
- Premiums captured in the value of entitlements
- Lower shadow values
- Effect over-estimated in EU-FARMIS

## EU-FARMIS (2)

### Differences between AROPAj and EU-FARMIS

- Methodological (CAP stylization)
  - o Transferability rules and land exchange between farm groups in EU-FARMIS (rental price equilibrium)
  - o Non-eligible lands existing in EU-FARMIS
- Technical (farming)
  - o Split of the land between arable lands and grasslands
  - o Wider range of productions in EU-FARMIS (wine, ...)
- Mathematical
  - o PMP (EU-FARMIS) vs MIP-LP (AROPAj)

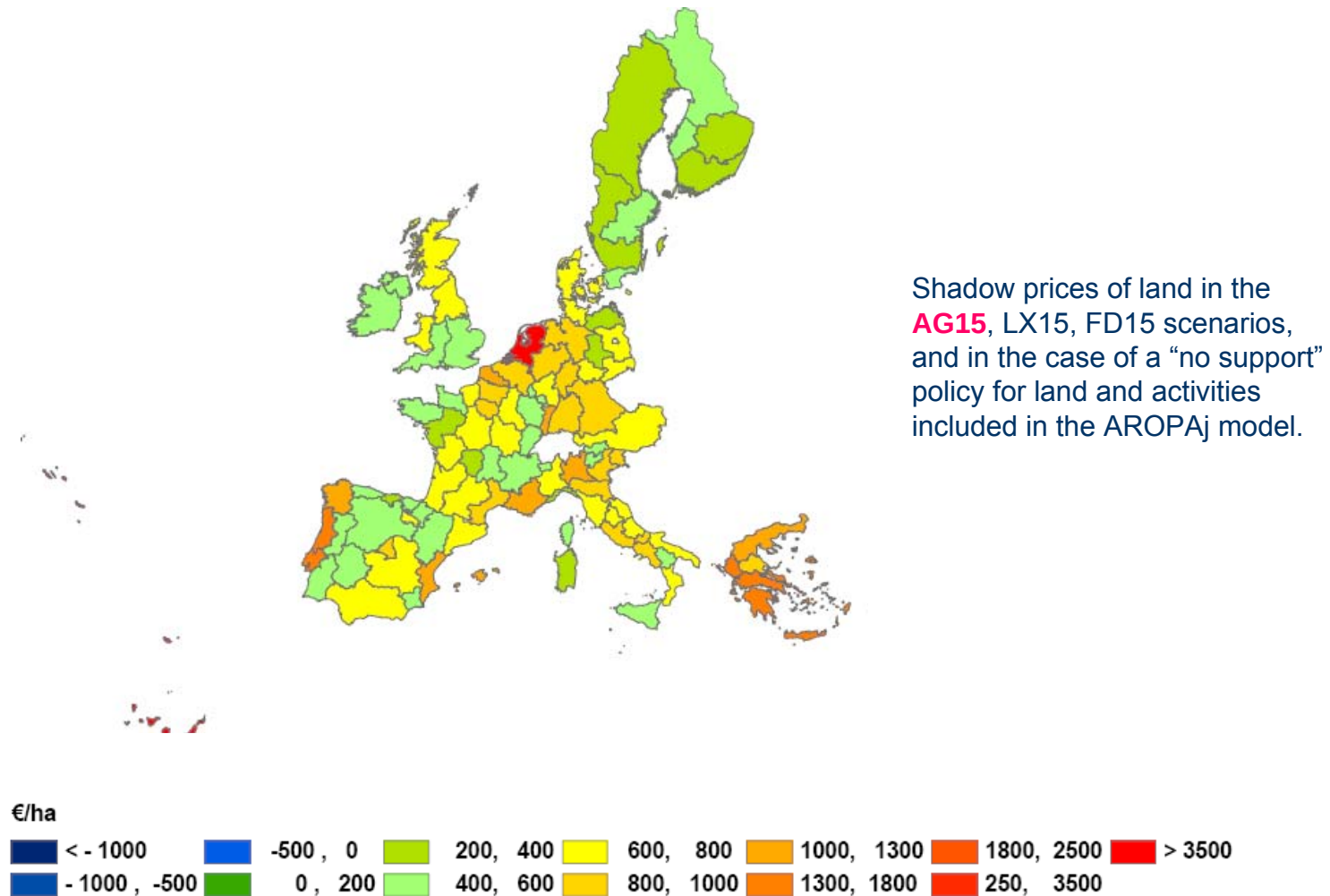
## PROMAPA.G (1)

|                                                                                               | Dual value of non irrigated land (€) in base year 2002 | Type of decoupling | Dual value and entitlement per ha in non irrigated land |           |                |                  |               |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------|---------------------------------------------------------|-----------|----------------|------------------|---------------|
|                                                                                               |                                                        |                    | Entitlement(€)                                          | Dual      |                | Dual+Entitlement |               |
|                                                                                               |                                                        |                    |                                                         | Value (€) | Var %          | Value (€)        | Var %         |
| AGGREGATED RESULTS                                                                            | 211,74                                                 | PARTIAL            | 146,92                                                  | 41,66     | <b>-80,32</b>  | 188,58           | <b>-10,94</b> |
|                                                                                               |                                                        | FULL               | 187,93                                                  | 28,50     | <b>-86,54</b>  | 216,43           | <b>2,21</b>   |
| 04 BASQUE COUNTRY                                                                             | 643,78                                                 | PARTIAL            | 238,99                                                  | 349,99    | <b>-45,64</b>  | 588,98           | <b>-8,51</b>  |
|                                                                                               |                                                        | FULL               | 298,03                                                  | 285,65    | <b>-55,63</b>  | 583,68           | <b>-9,34</b>  |
| 05 NAVARRE                                                                                    | 441,35                                                 | PARTIAL            | 156,96                                                  | 243,68    | <b>-44,79</b>  | 400,64           | <b>-9,22</b>  |
|                                                                                               |                                                        | FULL               | 201,31                                                  | 200,28    | <b>-54,62</b>  | 401,59           | <b>-9,01</b>  |
| 07 ARAGON                                                                                     | 162,3                                                  | PARTIAL            | 130,04                                                  | 7,67      | <b>-95,27</b>  | 137,71           | <b>-15,15</b> |
|                                                                                               |                                                        | FULL               | 167,86                                                  | 0,00      | <b>-100,00</b> | 167,86           | <b>3,43</b>   |
| 08 CATALONIA                                                                                  | 375,86                                                 | PARTIAL            | 184,33                                                  | 168,62    | <b>-55,14</b>  | 352,95           | <b>-6,10</b>  |
|                                                                                               |                                                        | FULL               | 238,00                                                  | 122,24    | <b>-67,48</b>  | 360,24           | <b>-4,16</b>  |
| 10 CASTILE and LEON                                                                           | 156,71                                                 | PARTIAL            | 140,72                                                  | 0,00      | <b>-100,00</b> | 140,72           | <b>-10,20</b> |
|                                                                                               |                                                        | FULL               | 177,75                                                  | 0,00      | <b>-100,00</b> | 177,75           | <b>13,43</b>  |
| 11 MADRID                                                                                     | 448,02                                                 | PARTIAL            | 151,40                                                  | 301,17    | <b>-32,78</b>  | 452,57           | <b>1,02</b>   |
|                                                                                               |                                                        | FULL               | 195,53                                                  | 269,74    | <b>-39,79</b>  | 465,27           | <b>3,85</b>   |
| 12 CASTILE-LA MANCHA                                                                          | 222,03                                                 | PARTIAL            | 124,29                                                  | 71,59     | <b>-67,76</b>  | 195,88           | <b>-11,78</b> |
|                                                                                               |                                                        | FULL               | 160,18                                                  | 40,11     | <b>-81,93</b>  | 200,29           | <b>-9,79</b>  |
| 15 EXTREMADURA                                                                                | 122,31                                                 | PARTIAL            | 154,30                                                  | 0,00      | <b>-100,00</b> | 154,30           | <b>26,15</b>  |
|                                                                                               |                                                        | FULL               | 200,05                                                  | 0,00      | <b>-100,00</b> | 200,05           | <b>63,56</b>  |
| 16 ANDALUSIA                                                                                  | 242,99                                                 | PARTIAL            | 220,56                                                  | 0,00      | <b>-100,00</b> | 220,56           | <b>-9,23</b>  |
|                                                                                               |                                                        | FULL               | 287,77                                                  | 0,00      | <b>-100,00</b> | 287,77           | <b>18,43</b>  |
| Var (%)= Percentage of variation of the value with respect to the dual value of the base year |                                                        |                    |                                                         |           |                |                  |               |

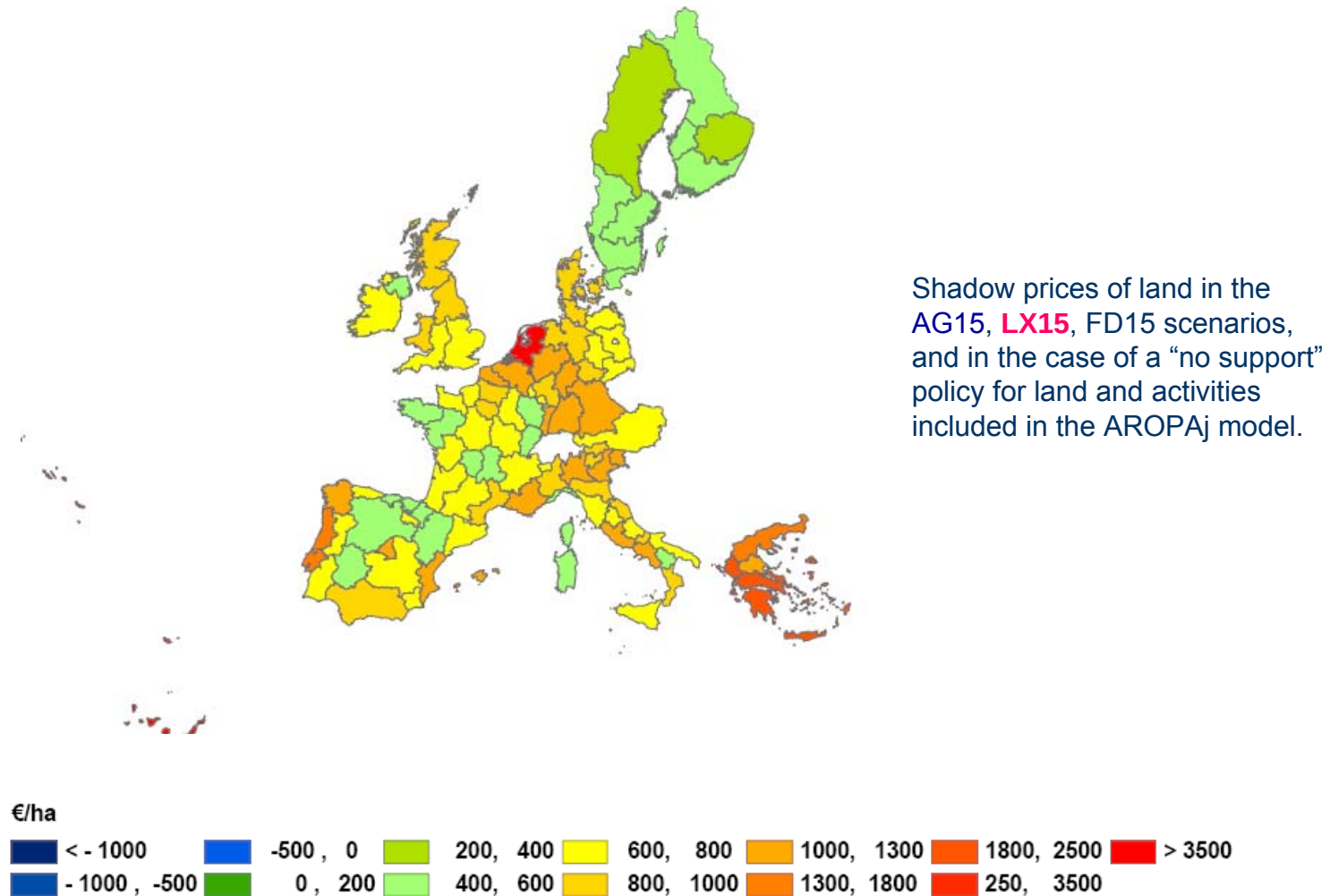
## PROMAPA.G (2)

- The PROMAPA.G model generates two land value indicators: the dual land value and the entitlement payment per hectare. The dual value relates to the revenue per ha of cultivated crops (including only coupled direct payments) while the entitlement payment corresponds to the decoupled payments per eligible ha.
- With increasing degrees of decoupling the dual values will decrease while the entitlement payment per ha will increase.
- The Table refers to non irrigated land values, using data from average TF 1310 – specialist cereals (other than rice), oilseed and protein crops – in different Spanish NUTS II where this TF is conducted. The simulation results are obtained with PROMAPA.G assuming constant base year prices for full and partial decoupling scenarios.
- To compare the dual values of land in the base year (when all direct payments are coupled) with land value in decoupled scenarios (partial and full) entitlement payment per ha must be taken into account and added to the dual values obtained

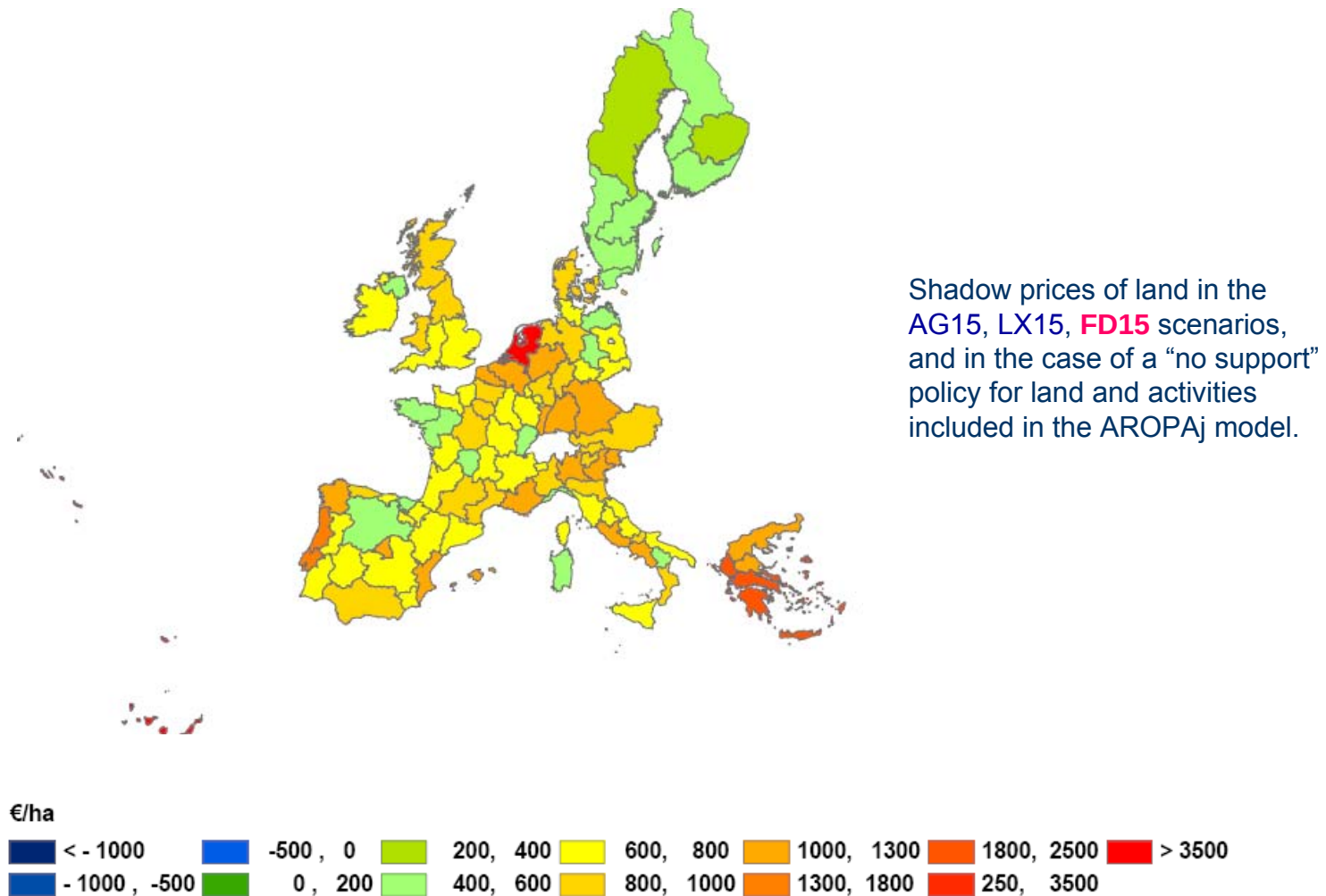
## Regional scale



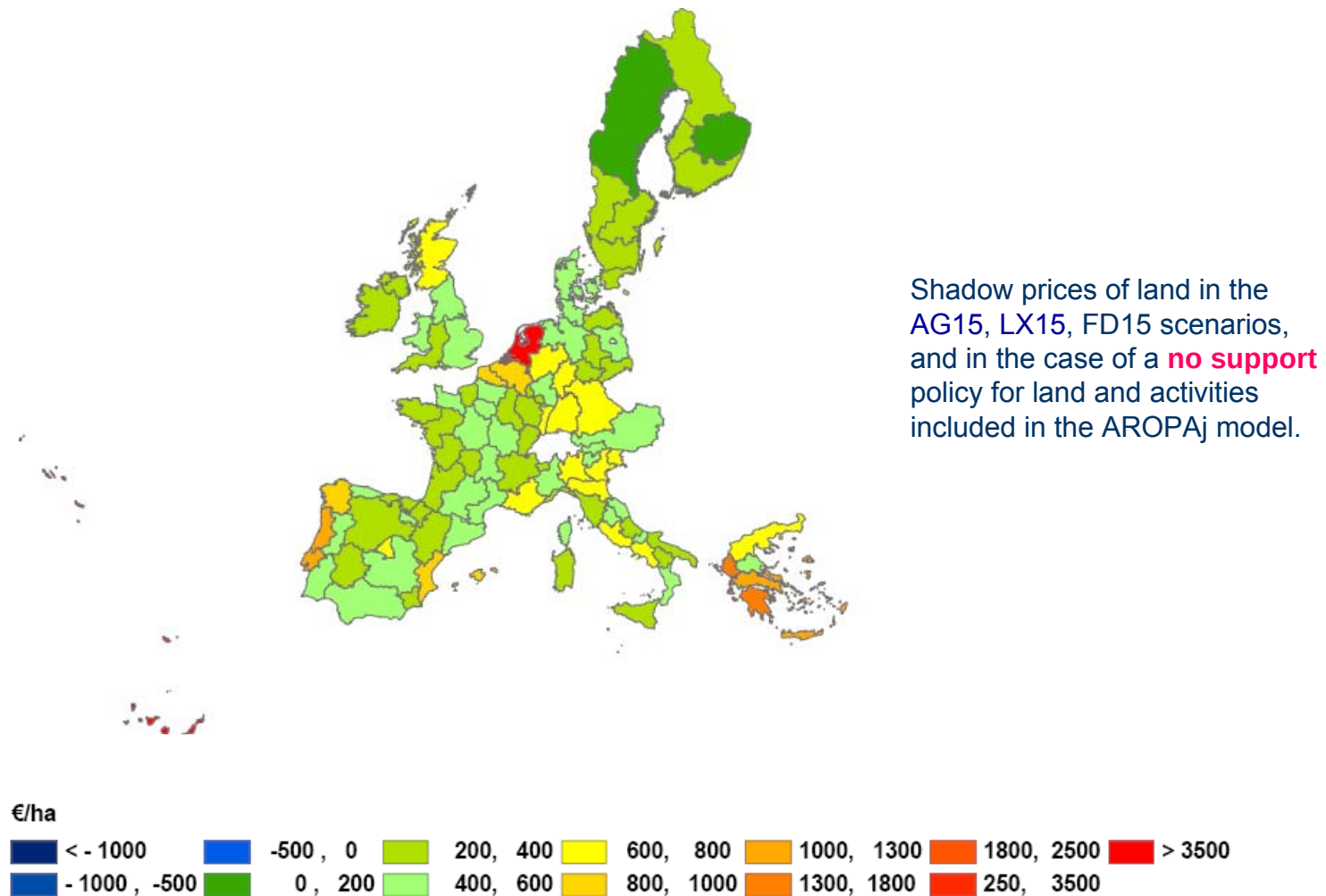
## Regional scale



## Regional scale

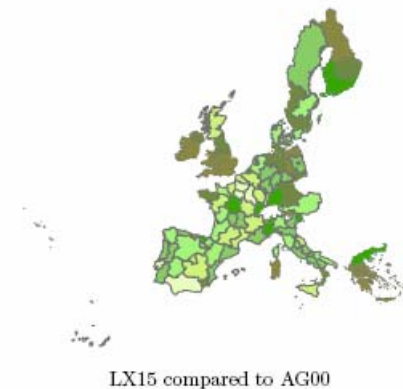
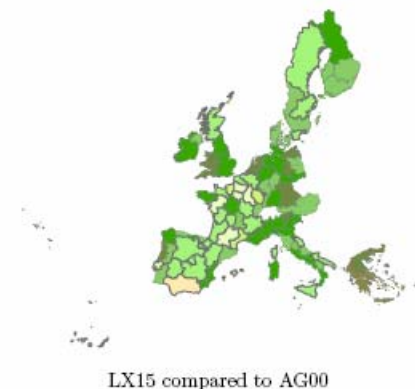


## Regional scale

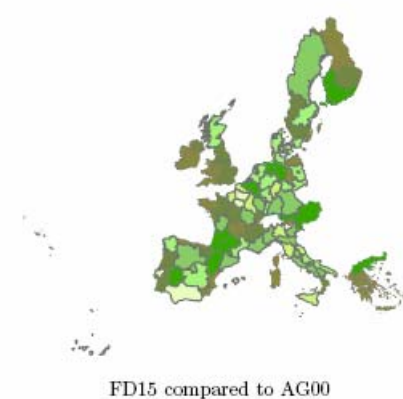
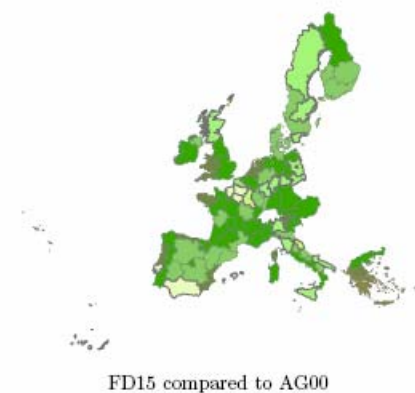


## Regional scale

Regional increase in the shadow price of land when the CAP is evaluated according to the LX15 or the FD15 scenario (€/ha).



Regional increase in the shadow price of land when the CAP is evaluated according to the LX15 or the FD15 scenario (% of the AG00 regional shadow price).



## Change due to environmental policies

Cross-compliance CAP measures and future environmental policies should impact on the value of the land, taking account

- point source pollution problem
- non-point source pollution problem

(NPS problem possibly transformed in PS problem through « maximum entropy method » developed by one Genedec partner under data

requirements: [http://www.grignon.inra.fr/economie-publique/genedec/publi/deliv/WP5\\_D8.pdf](http://www.grignon.inra.fr/economie-publique/genedec/publi/deliv/WP5_D8.pdf))

A tougher regulation implied by the knowledge of individual emissions, might reduce in the short run the private economic profitability.

In the long run however, one might expect that the overall improvement of the quality of (i.e. water) resources will improve social profitability in a given area, but also private profitability if land prices embody environmental factors as in hedonic price equations.

## Change due to environmental policies

The Agenda 2000 CAP reform is expected to promote environmental integration into the communal agricultural policy. In order to maximize environmental benefits, both direct payments and pillar II measures are set under the principle of cross-compliance, a sanctioning approach incorporated into the horizontal regulation that involves penalties for environmental infringements entailing when appropriate, either partial or full removal of aid in the event of deviation from certain farming standards (EC, 1999). Furthermore, under the 2003 CAP reform if a farmer fails to comply with standards due to negligence then the reduction of payments varies between 5% and 15%, while payments are reduced by at least 20% and may also be completely withdrawn in the event of deliberate non-compliance.

If the transformation of NPS agricultural pollution problem to a PS problem allows adequate observability of individual emissions, then the environmental quality constraint, implied by Agenda 2000 can be transformed into constraints on inputs (water, fertilizers) and possibly on land. When these constraints are introduced into the mathematical programming models, the multipliers associated with the constraints, will provide additional shadow values which embody environmental considerations, and which can be used to adjust the shadow price related to land.

## Caveats

Key points when analysing the link between shadow prices of land delivered by farm models and land market :

- transferability of payments should be taken into account
- anticipation of future change  
(CAP and environmental policies, economic environment – i.e. energy price)
- taking account the non-food agricultural products and policies  
(bio-energy and related incentives)
- competition with non agricultural uses of the land