SMILE Meeting Scotland

Presentation of a general template for the presentation of Cases study and examples of MuSIASEM applications

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ICTA-UAB

The role of the SMILE cases study in this Work Package

The object of analysis carried out in the case study

A socio-economic system to be characterized in an integrated way in relation to an issue of sustainability

The purpose of the analysis at this stage

A quantitative characterization of the issue addressed in the case study illustrating the potentialities of the DECOIN tool kit

Pointing at new perspectives, findings, explanations in relation to the case study, and formulation of research questions to be answered in the remaining activities of the SMILE project

Follow-up

Further application of the tool kit on the research question indicated in this first phase

The general structure of a SMILE case study in this Work Package

The case study A multi-scale integrated analysis of the performance of Catalonia in relation to the issue of sustainability

The methodologies of the tool-kit used MuSIASEM, SUMMA, ASA

Documents produced

MuSIASEM analysis of Catalonia – historic series, comparison with EU, plus presenting a few ideas for futher elaboration

MuSIASEM analysis of Catalonia – paper on policy implications

MuSIASEM analysis of Catalonia – household metabolism

MuSIASEM analysis of Catalonia – land use metropolitan area

SUMMA analysis of Catalonia – assessment of natural support ecosystems

ASA analysis of Catalonia – decomposition analysis historic series (energy intensity)

Follow-up

Comparison of the trajectory of Ireland and Catalonia
???

The general structure of a SMILE case study in this Work Package

The case study A multi-scale integrated analysis of the performance of rural LAOS in relation to the issue of sustainability

The methodologies of the tool-kit used MuSIASEM, SUMMA

Documents produced

MuSIASEM analysis of Laos – multiscale and spatial analysis of rural LAOS

SUMMA analysis of LAOS – assessment of natural support ecosystems

Follow-up

Check if the same approach can be followed for the forestry case study of Finland

???

The general structure of a SMILE case study in this Work Package

The case study A multi-scale integrated analysis of the performance of Romania in relation to the issue of sustainability

The methodologies of the tool-kit used MuSIASEM, SUMMA?

Documents produced

MuSIASEM analysis of Romania – historic series, comparison with EU

MuSIASEM analysis of Romania – quality of data

MuSIASEM analysis of Romania – going to level n-3 and n-4 in the service sector

Integrated analysis of Romania – black economy and emigration (Lucien paper)

SUMMA analysis of Romania? – assessment of natural support ecosystems

Follow-up

Comparison of the trajectory of ?

???

The general structure of a SMILE case study in this Work Package

The case study A multi-scale integrated analysis of the performance of the agricultural sector of Campania in relation to the issue of sustainability

The methodologies of the tool-kit used MuSIASEM, SUMMA, ASA

Documents produced

SUMMA analysis of the agricultural sector of Campania – historic series, comparison with Italy, characterization across levels (national to farm level)

MuSIASEM analysis of the Campania case study – socio-economic interface

ASA analysis of the Campania case study – decomposition analysis historic series

Follow-up

Comparison of . . .
???

The general structure of a SMILE case study in this Work Package

The case study A multi-scale integrated analysis of the performance of the forestry sector in Finland in relation to the issue of sustainability

The methodologies of the tool-kit used MuSIASEM, SUMMA, ASA

Documents produced

MuSIASEM analysis of the forestry sector in Finland – scaling and heterogeneity looking for relevant types and looking for geographic differences

SUMMA analysis of the performance of different typologies of production and different areas

ASA analysis of the forestry sector in Finland – decomposition analysis historic series

Follow-up

Check hypothesis and verify the possibility of performing a more effective analysis ???

The case study of Catalonia

A multi-scale integrated analysis of the performance of Catalonia in relation to the issue of sustainability

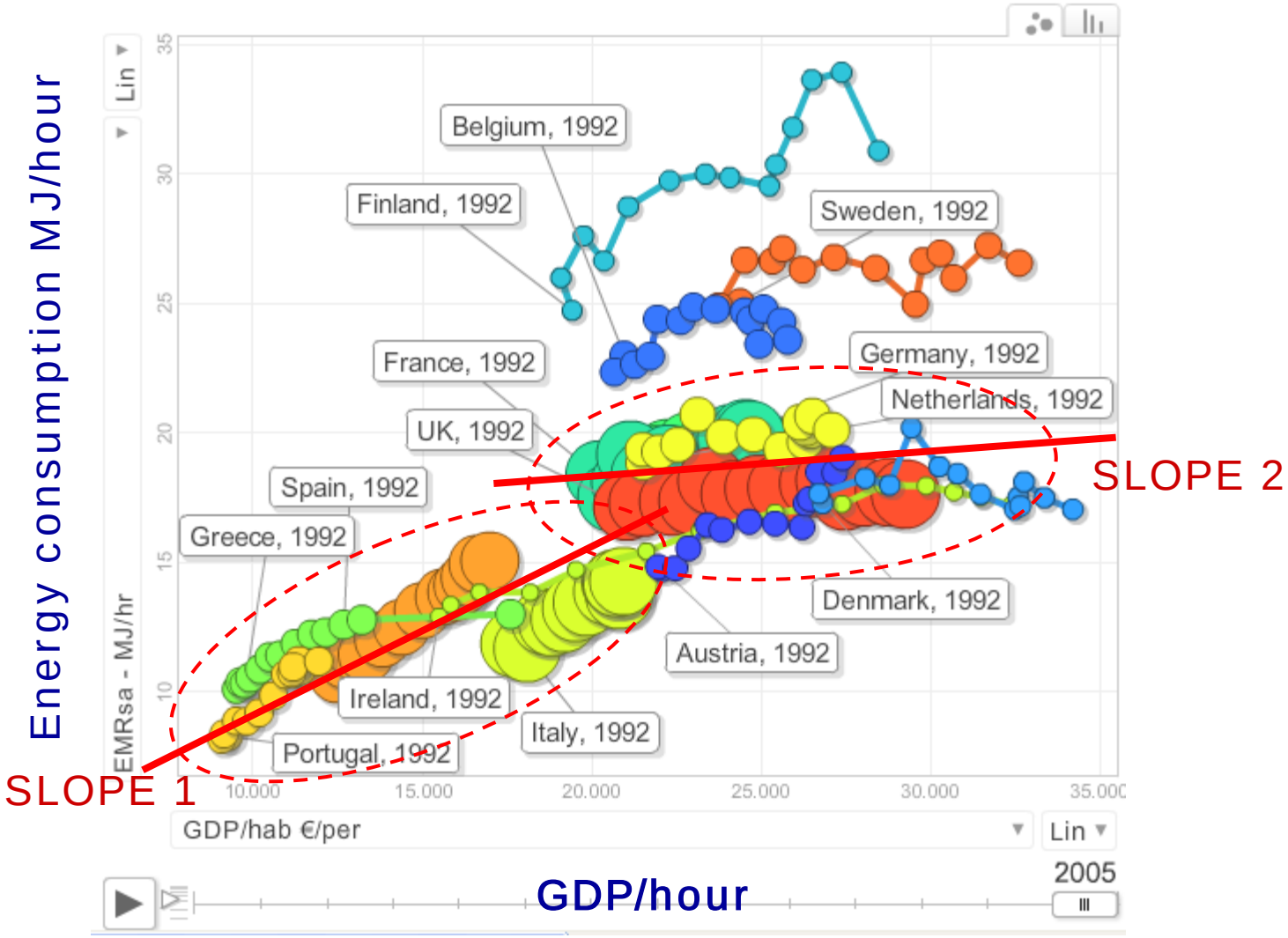
Using MuSIASEM to study across levels the metabolic pattern of Catalonia in comparison with EU countries

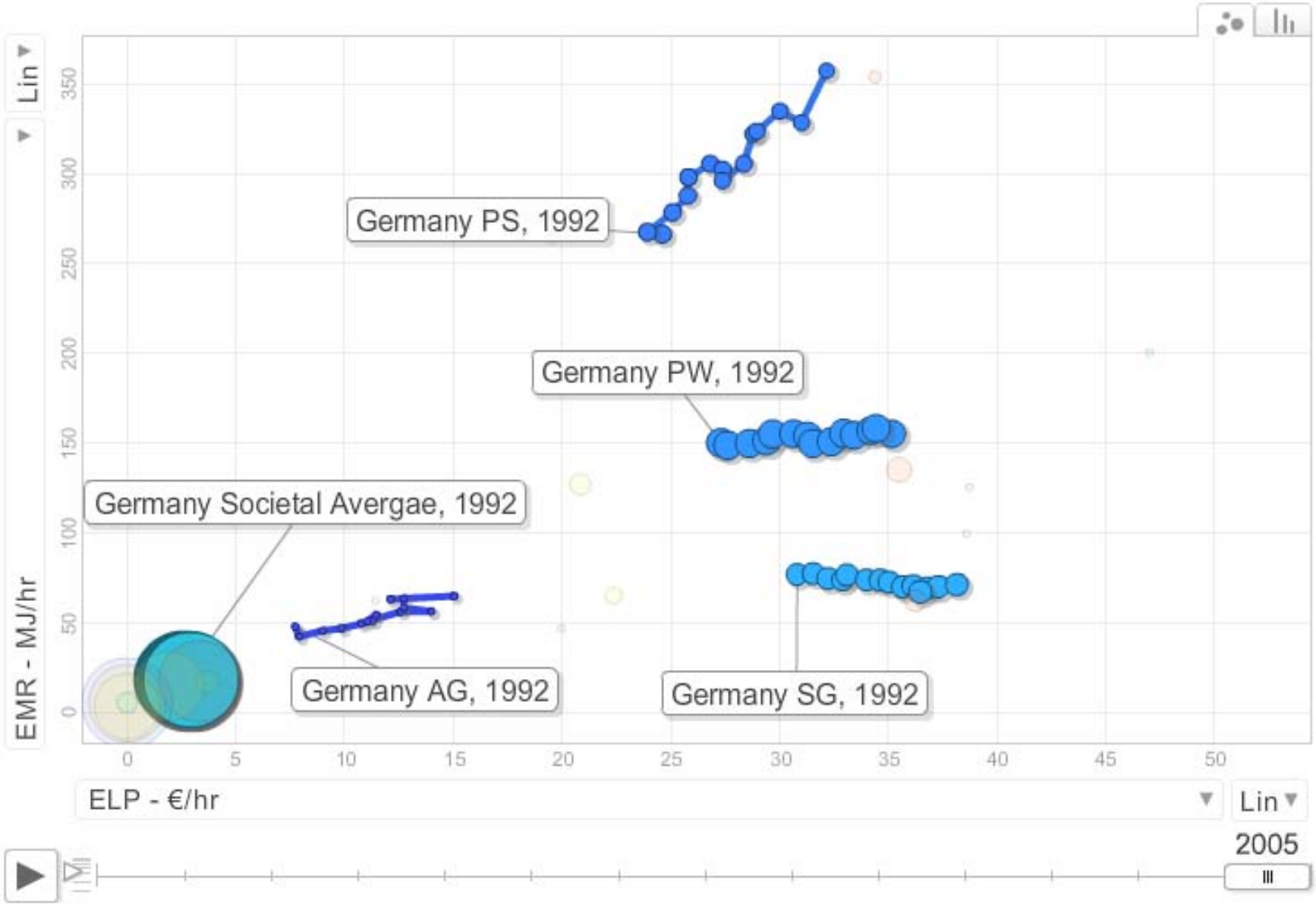
The importance of going multiscale

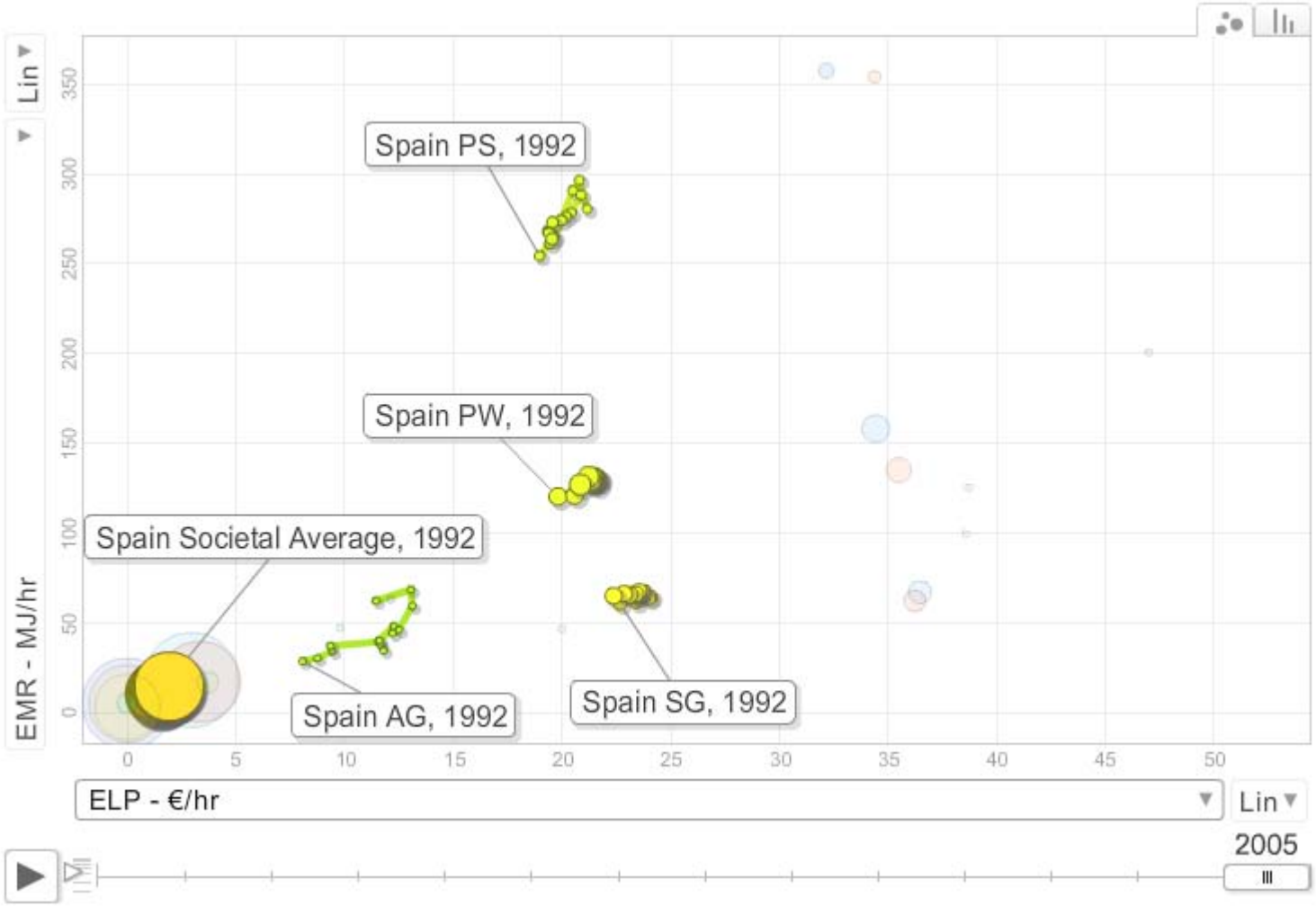
Indicators relevant for the I=PAT relation and the "black-box level"(level n)

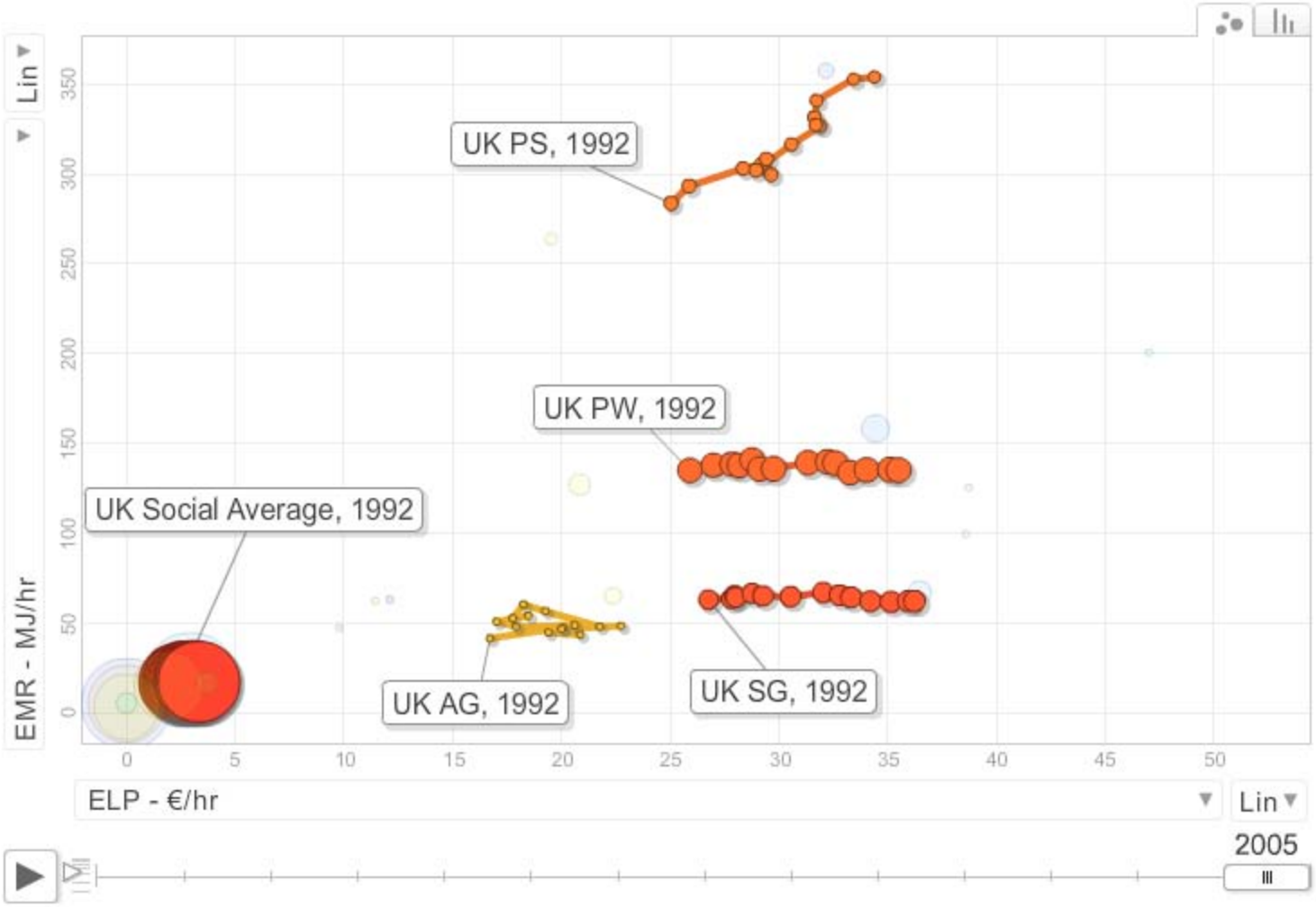
	Spain	Germany	U.K.
I - CO2 Emissions p.c. (ton/year)	352	897	558
P – Population (millions)	42.3	82.5	50.1
A - GDP per capita (€/year)	**17,900**	**26,800**	**27,000**
T - CO2 Emission Intensity (kg/€)	**0.46**	**0.41**	**0.35**

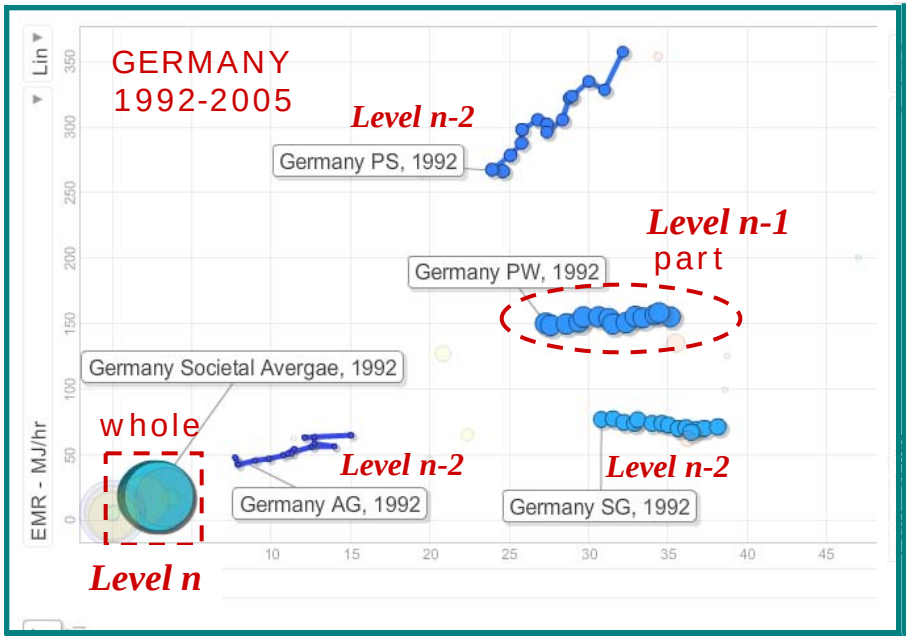
Level n Average Society

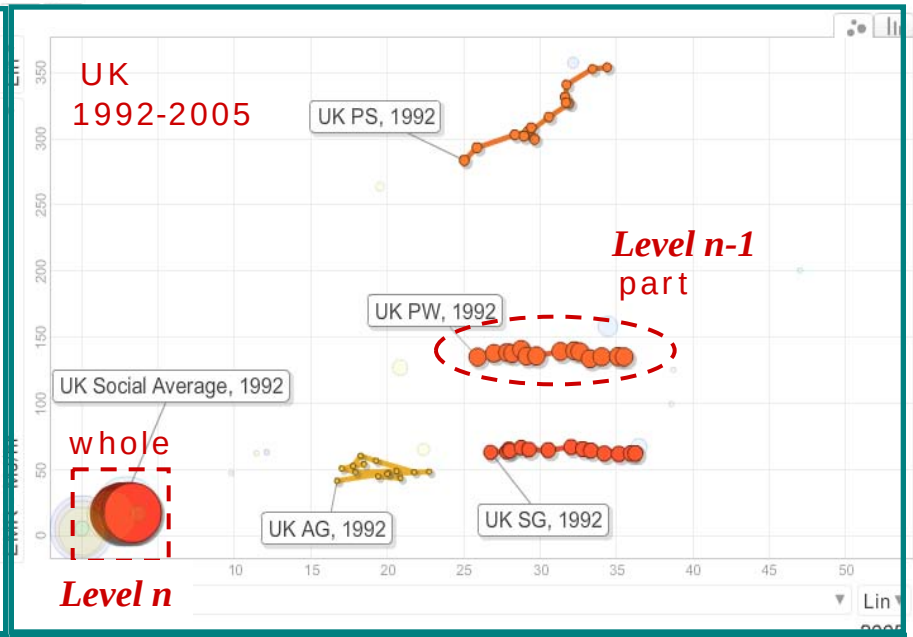


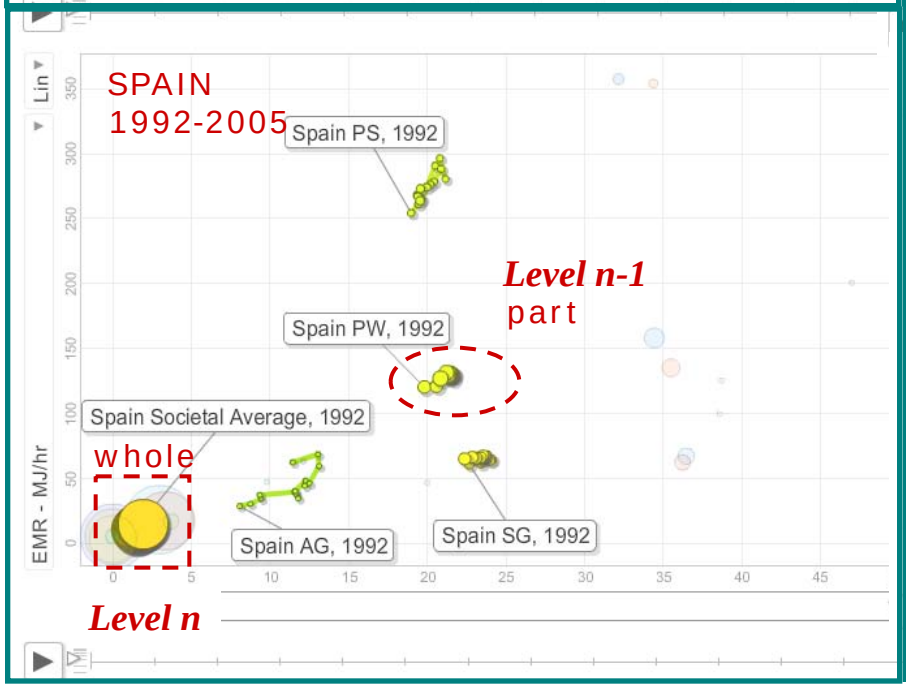

Lin
EMR - MJ/hr
350
300
250
200
150
100
50
0
Germany PS, 1992
Germany PW, 1992
Germany Societal Avergae, 1992
Germany AG, 1992
Germany SG, 1992
0
5
10
15
20
25
30
35
40
45
50
ELP - €/hr
Lin
2005

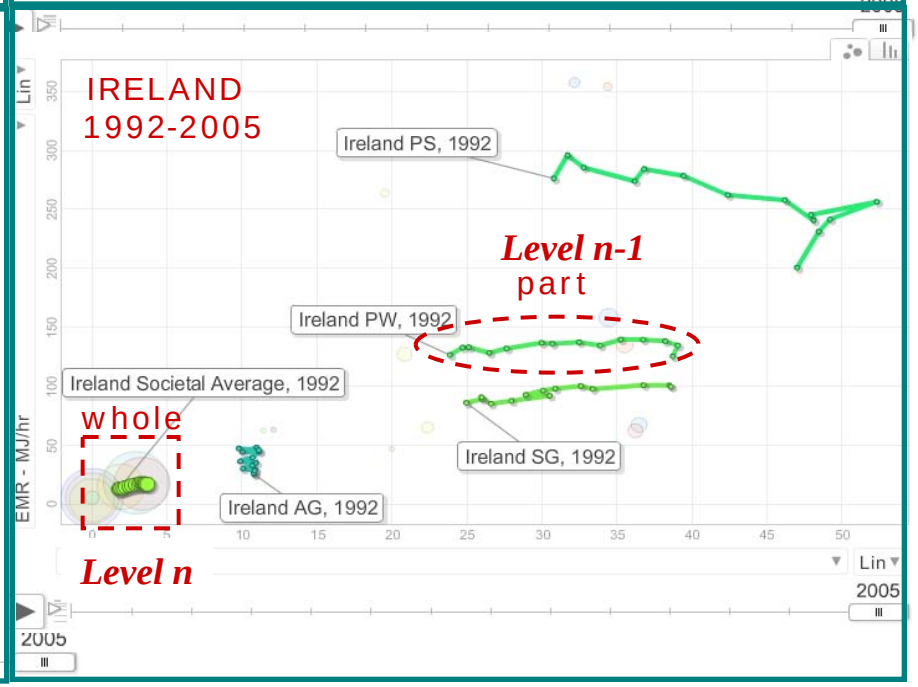

Lin
EMR - MJ/hr
0
50
100
150
200
250
300
350
Spain PS, 1992
Spain PW, 1992
Spain Societal Average, 1992
Spain AG, 1992
Spain SG, 1992
0
5
10
15
20
25
30
35
40
45
50
ELP - €/hr
Lin
2005

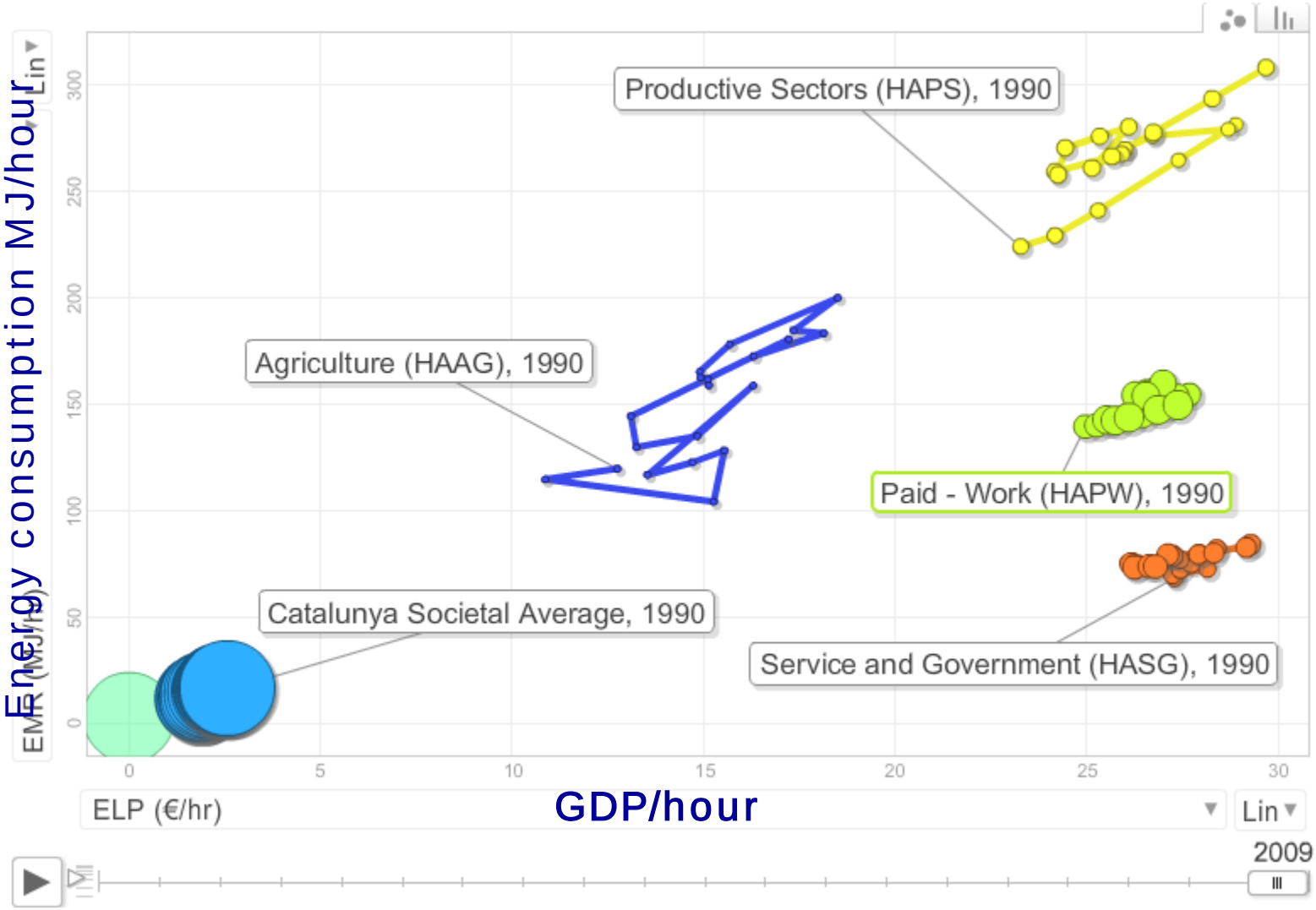

Lin
EMR - MJ/hr
0
50
100
150
200
250
300
350
UK PS, 1992
UK PW, 1992
UK Social Average, 1992
UK AG, 1992
UK SG, 1992
0
5
10
15
20
25
30
35
40
45
50
ELP - €/hr
Lin
2005


GERMANY
1992-2005
Level n-2
Germany PS, 1992
Level n-1
part
Germany PW, 1992
Germany Societal Avergae, 1992
whole
Level n-2
Germany AG, 1992
Level n-2
Germany SG, 1992
Level n
EMR - MJ/hr

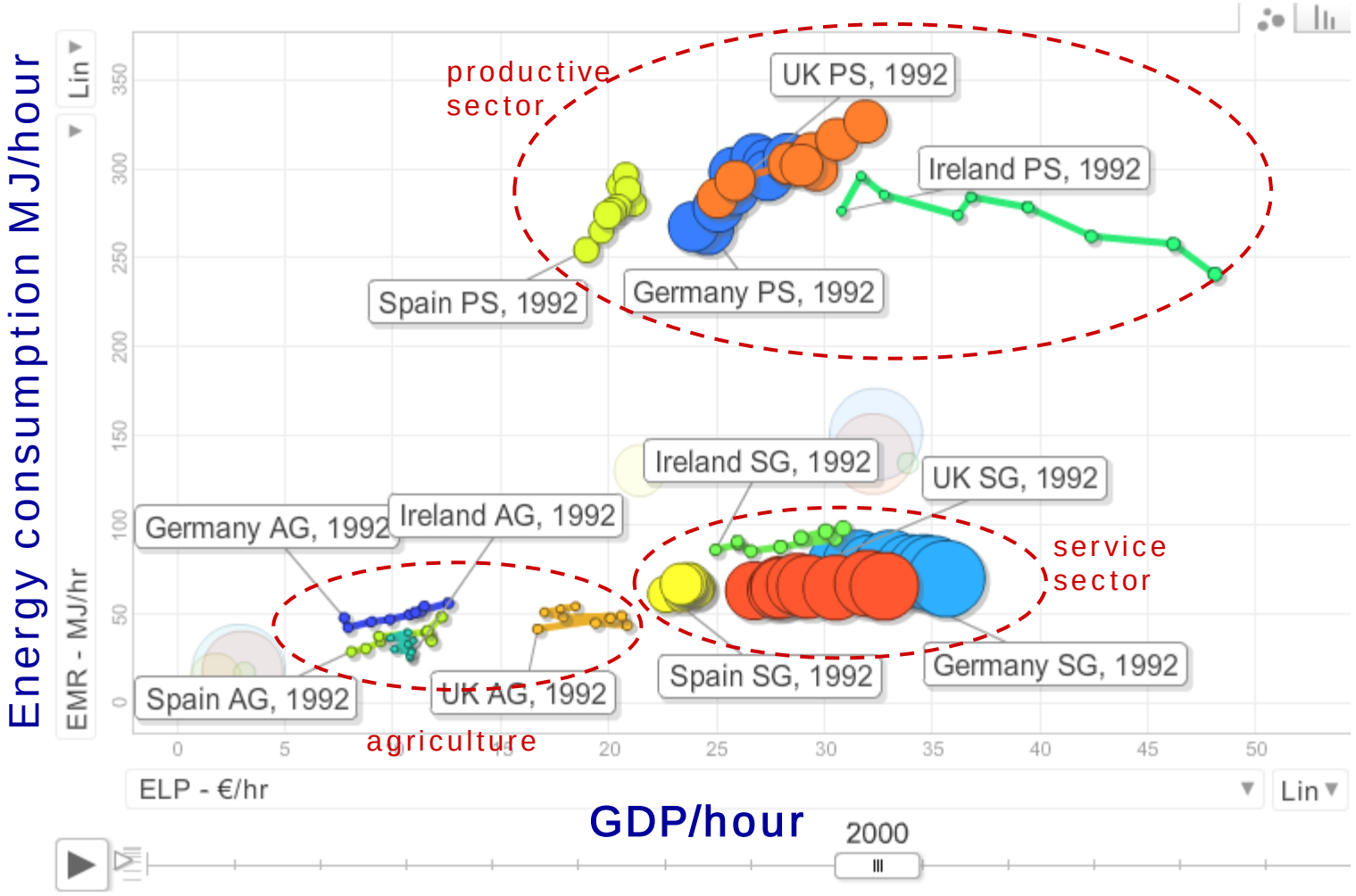

UK
1992-2005
UK PS, 1992
Level n-1
part
UK PW, 1992
UK Social Average, 1992
whole
UK AG, 1992
UK SG, 1992
Level n


SPAIN
1992-2005
Spain PS, 1992
Level n-1
part
Spain PW, 1992
Spain Societal Average, 1992
whole
Spain AG, 1992
Spain SG, 1992
Level n
EMR - MJ/hr

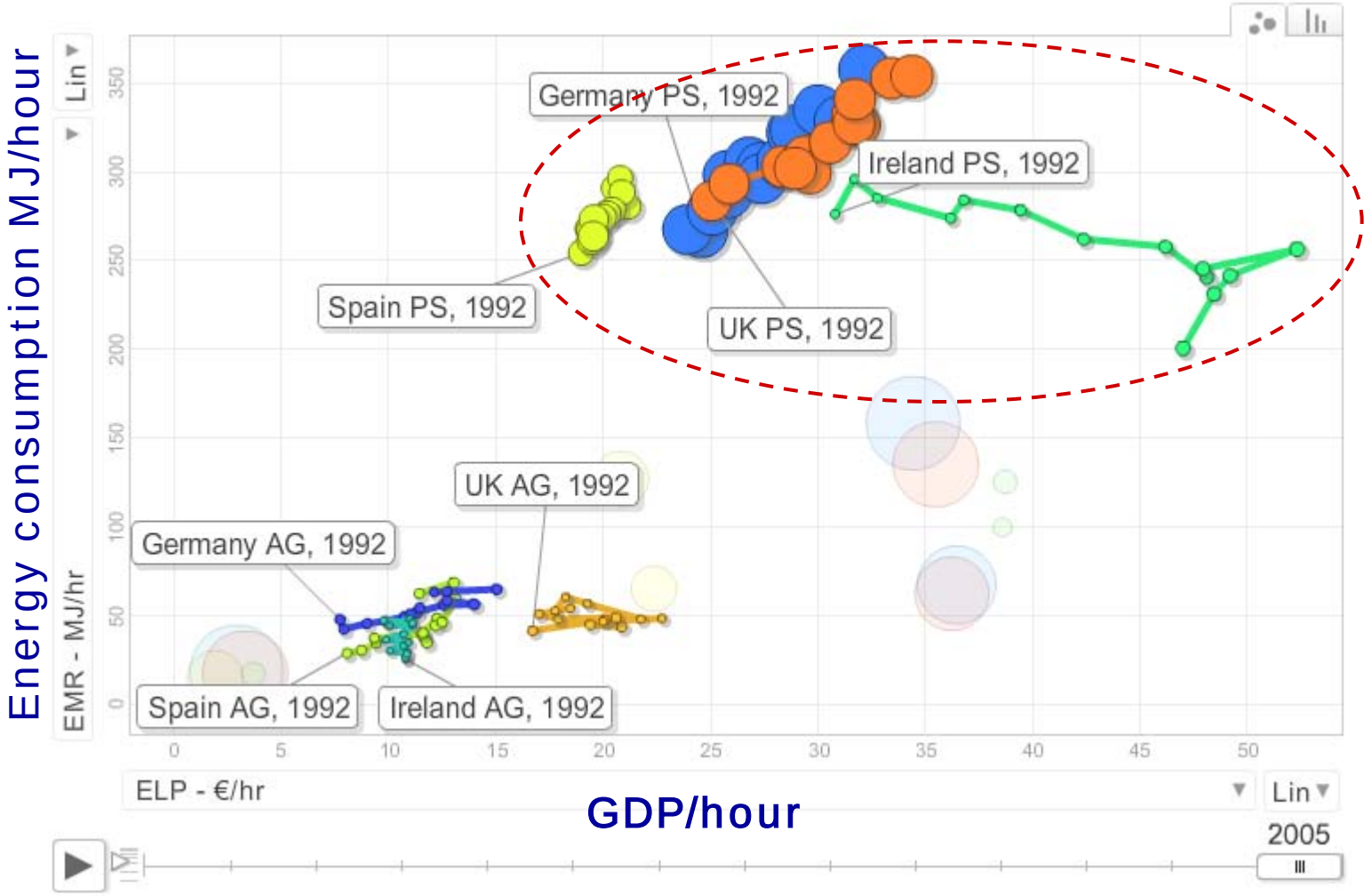

IRELAND
1992-2005
Ireland PS, 1992
Level n-1
part
Ireland PW, 1992
Ireland Societal Average, 1992
whole
Ireland AG, 1992
Ireland SG, 1992
Level n
EMR - MJ/hr


Energy consumption MJ/hour
EMR (MJ/hr)
Lin
300
250
200
150
100
50
0
Productive Sectors (HAPS), 1990
Agriculture (HAAG), 1990
Paid - Work (HAPW), 1990
Catalunya Societal Average, 1990
Service and Government (HASG), 1990
0
5
10
15
20
25
30
ELP (€/hr)
GDP/hour
Lin
2009

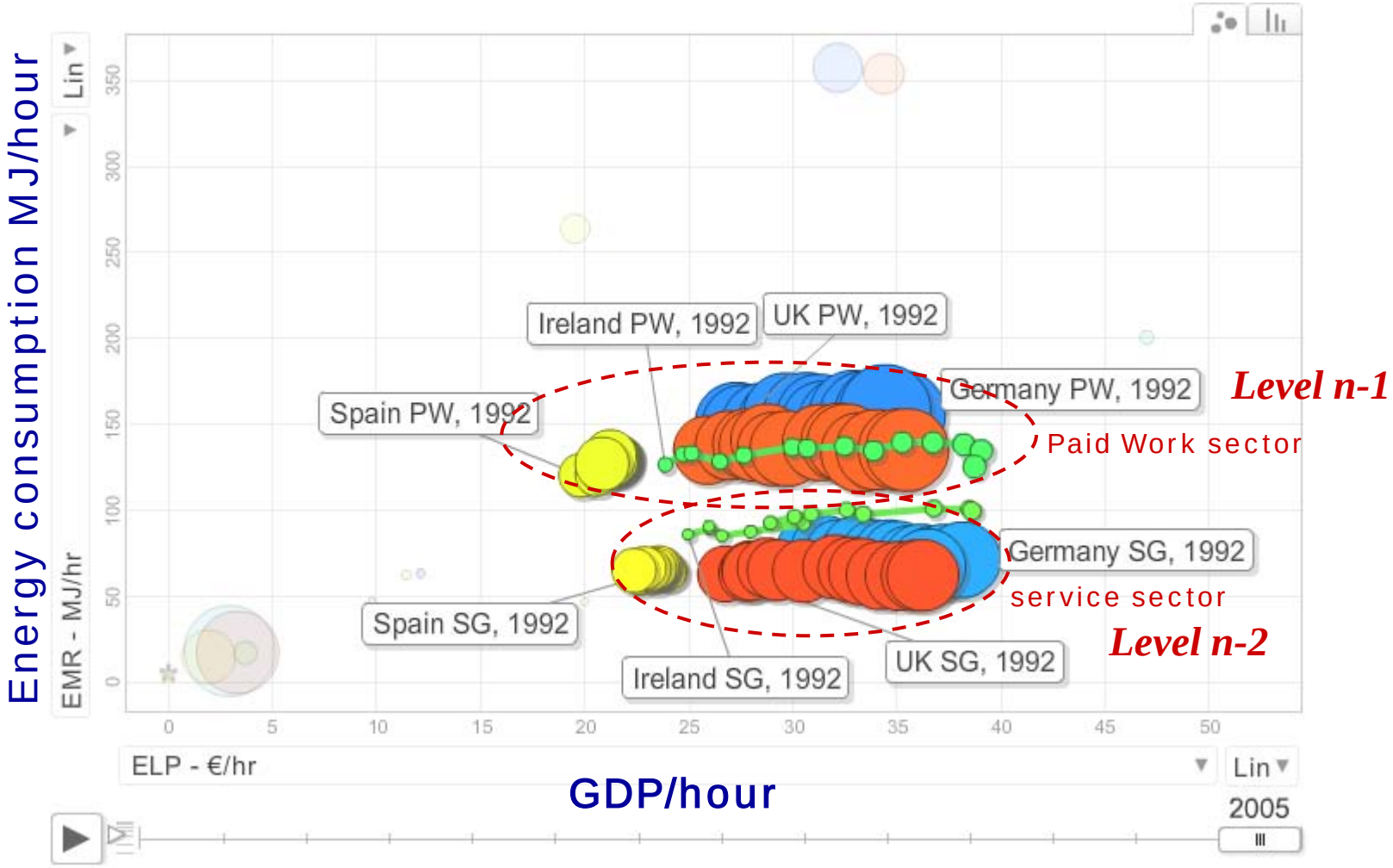
Exploring the metabolic pattern at level n-2



Exploring the metabolic pattern at level n-2



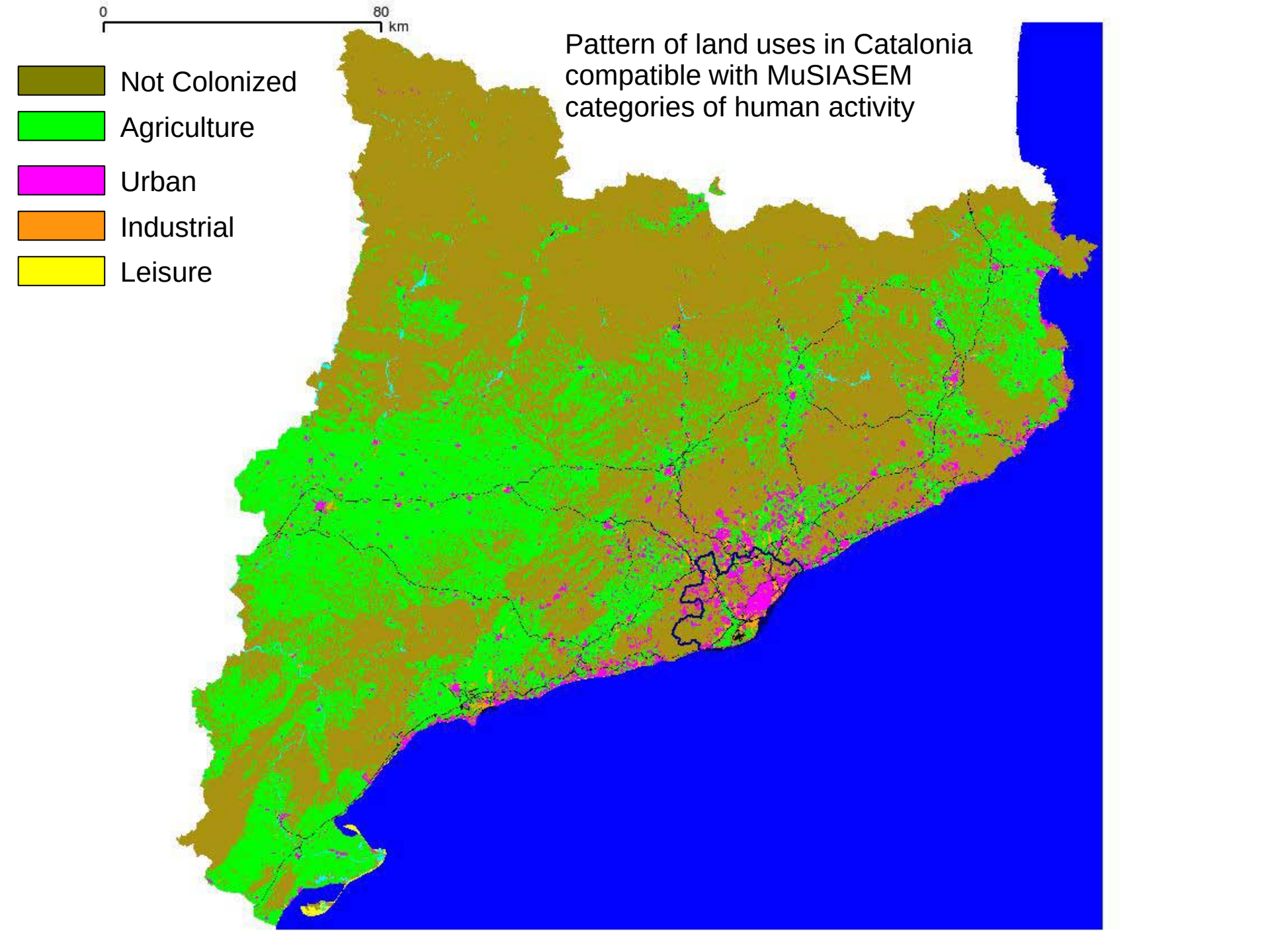
Comparing the metabolic pattern across level n-1 and level n-2



The case study of Catalonia

A multi-scale integrated analysis of the performance of Catalonia in relation to the issue of sustainability

Applying MuSIASEM to the density of flows per unit of land


0
80
km
Not Colonized
Agriculture
Urban
Industrial
Leisure
Pattern of land uses in Catalonia compatible with MuSIASEM categories of human activity

Severe heterogeneity and non linearity in the pattern of land-use in Catalonia

TAL – 3,210,000 ha 100%

NCL – 1,980,000 ha 61.6%

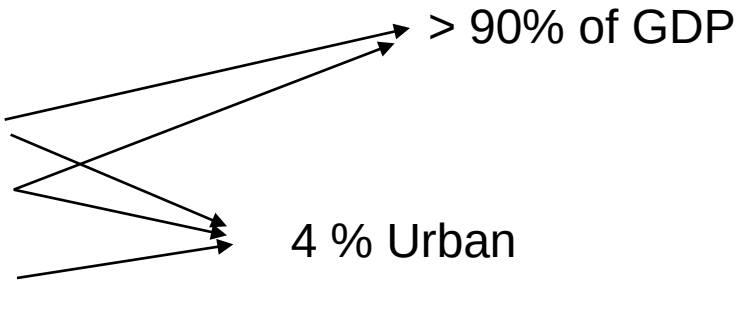
COL – 1,230,000 ha 38.4%

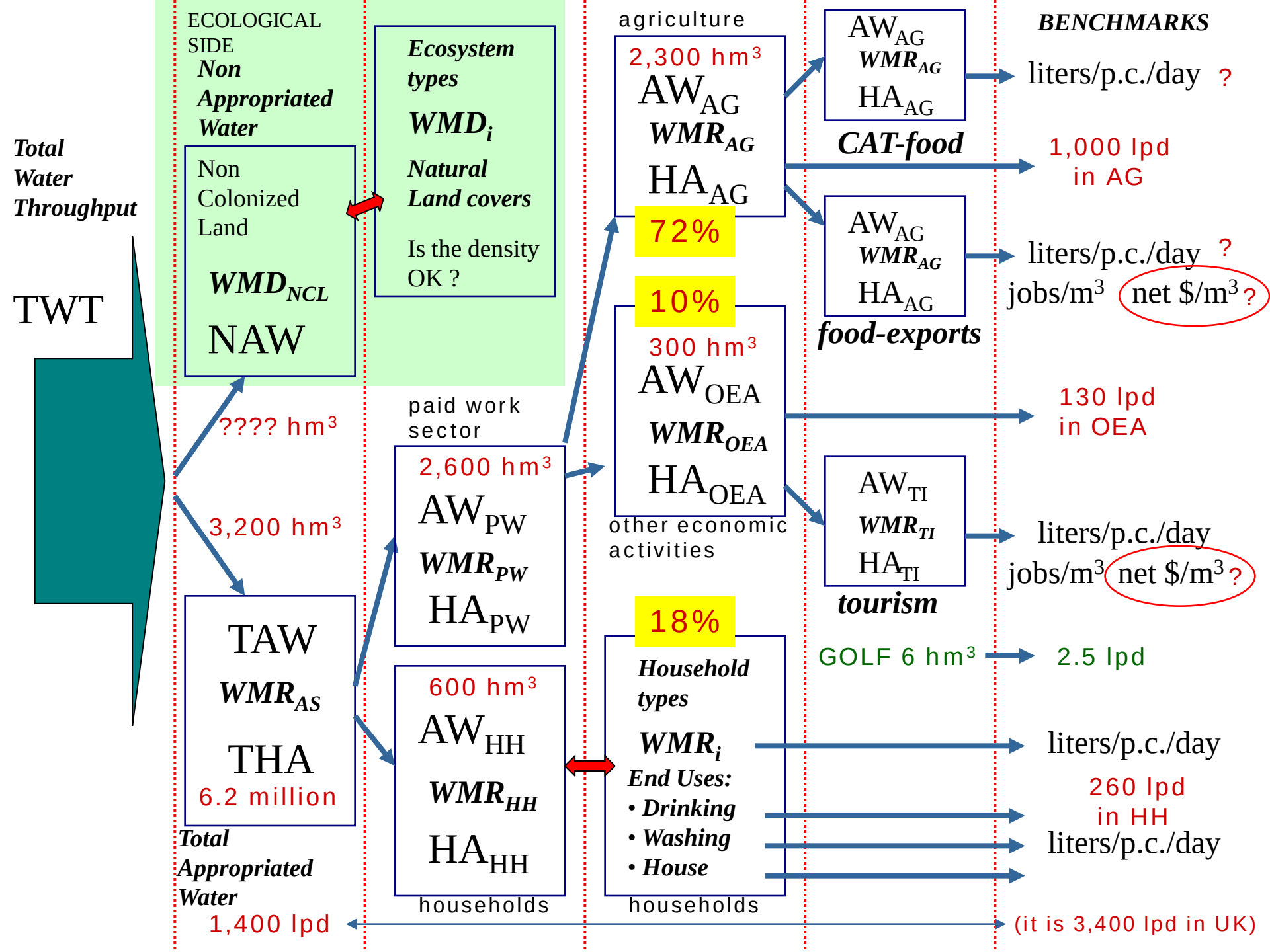
AG – 1,104,000 ha 34.4%

PS – 32,000 ha 1.0%

SG – 35,000 ha 1.2%

HH – 60,000 ha 1.8%




ECOLOGICAL SIDE
Non Appropriated Water
Total Water Throughput
TWT
Non Colonized Land
WMD_{NCL}
NAW
Ecosystem types
WMD_i
Natural Land covers
Is the density OK ?
???? hm³
3,200 hm³
TAW
WMR_{AS}
THA
6.2 million
Total Appropriated Water
1,400 lpd
paid work sector
2,600 hm³
AW_{PW}
WMR_{PW}
HA_{PW}
600 hm³
AW_{HH}
WMR_{HH}
HA_{HH}
households
agriculture
2,300 hm³
AW_{AG}
WMR_{AG}
HA_{AG}
72%
10%
300 hm³
AW_{OEA}
WMR_{OEA}
HA_{OEA}
other economic activities
18%
Household types
WMR_i
End Uses:
• Drinking
• Washing
• House
households
AW_{AG} WMR_{AG} HA_{AG}
CAT-food
AW_{AG} WMR_{AG} HA_{AG}
food-exports
AW_{TI} WMR_{TI} HA_{TI}
tourism
GOLF 6 hm³
BENCHMARKS
liters/p.c./day ?
1,000 lpd in AG
liters/p.c./day ?
jobs/m³ net $/m³ ?
130 lpd in OEA
liters/p.c./day
jobs/m³ net $/m³ ?
2.5 lpd
liters/p.c./day
260 lpd in HH
liters/p.c./day
(it is 3,400 lpd in UK)

Examples of the hard work of
Agustin and Miguel

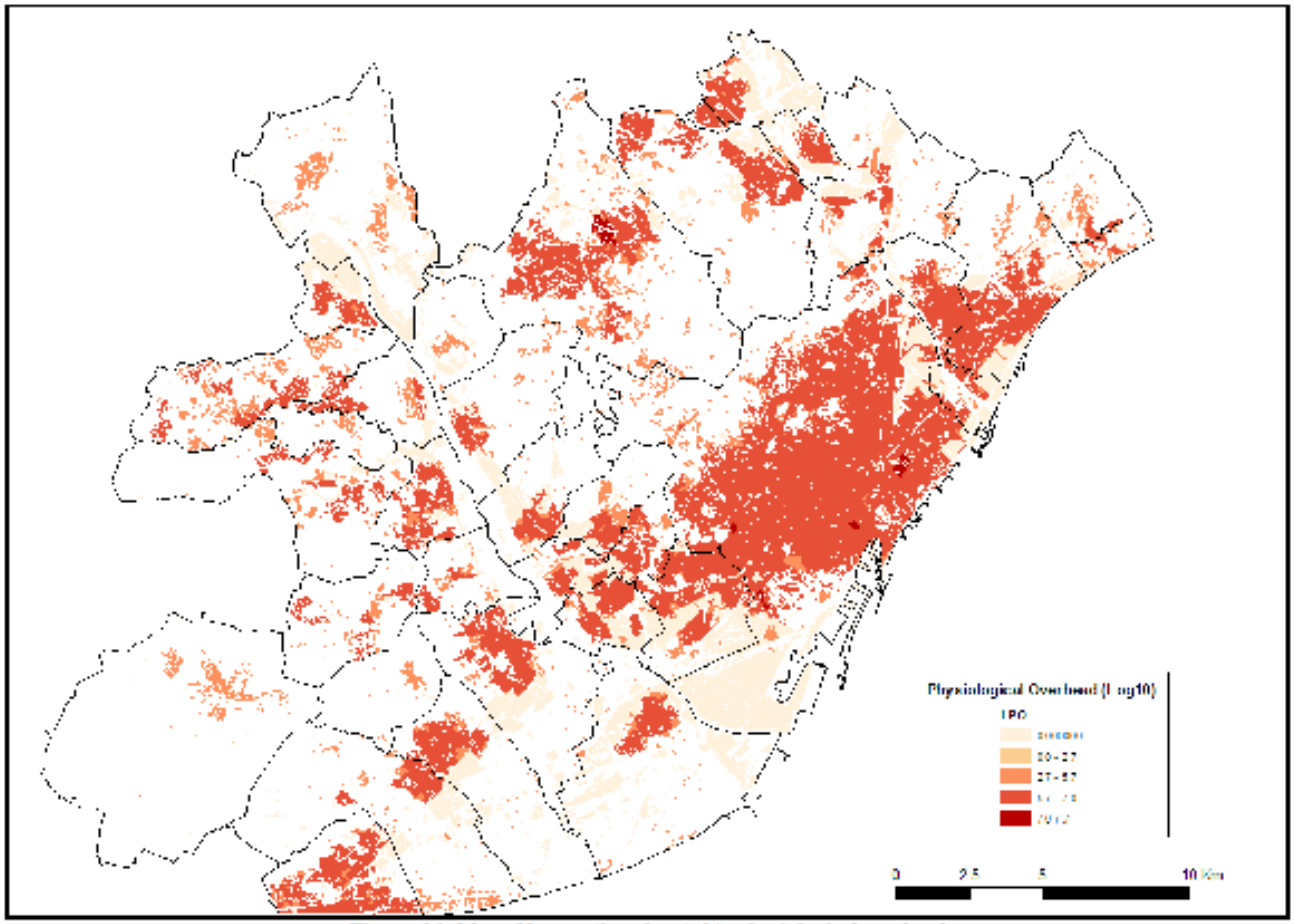


Figure A1. Map of human time devoted to physiological overhead

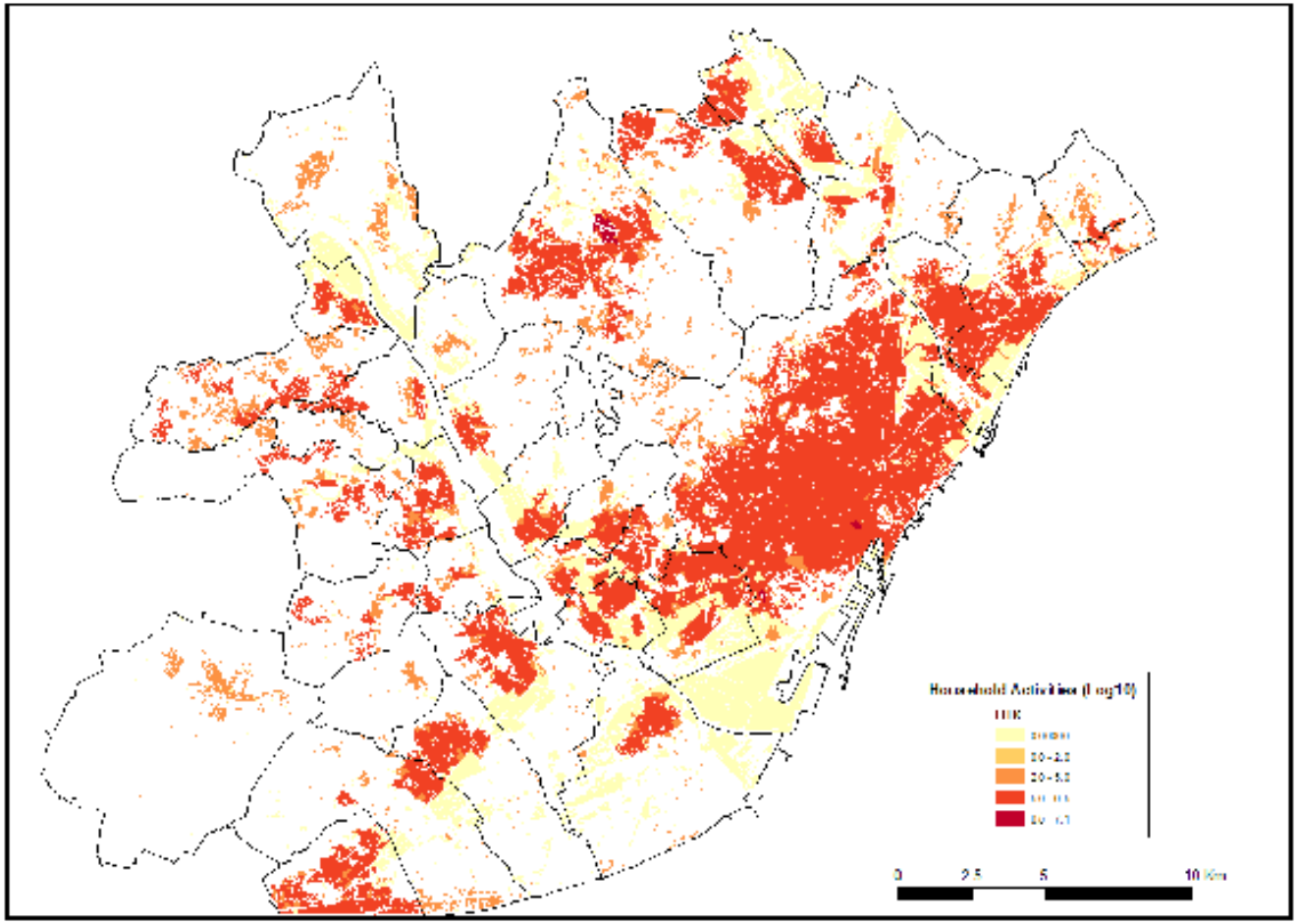


Figure A2. Map of human time devoted to household activities.

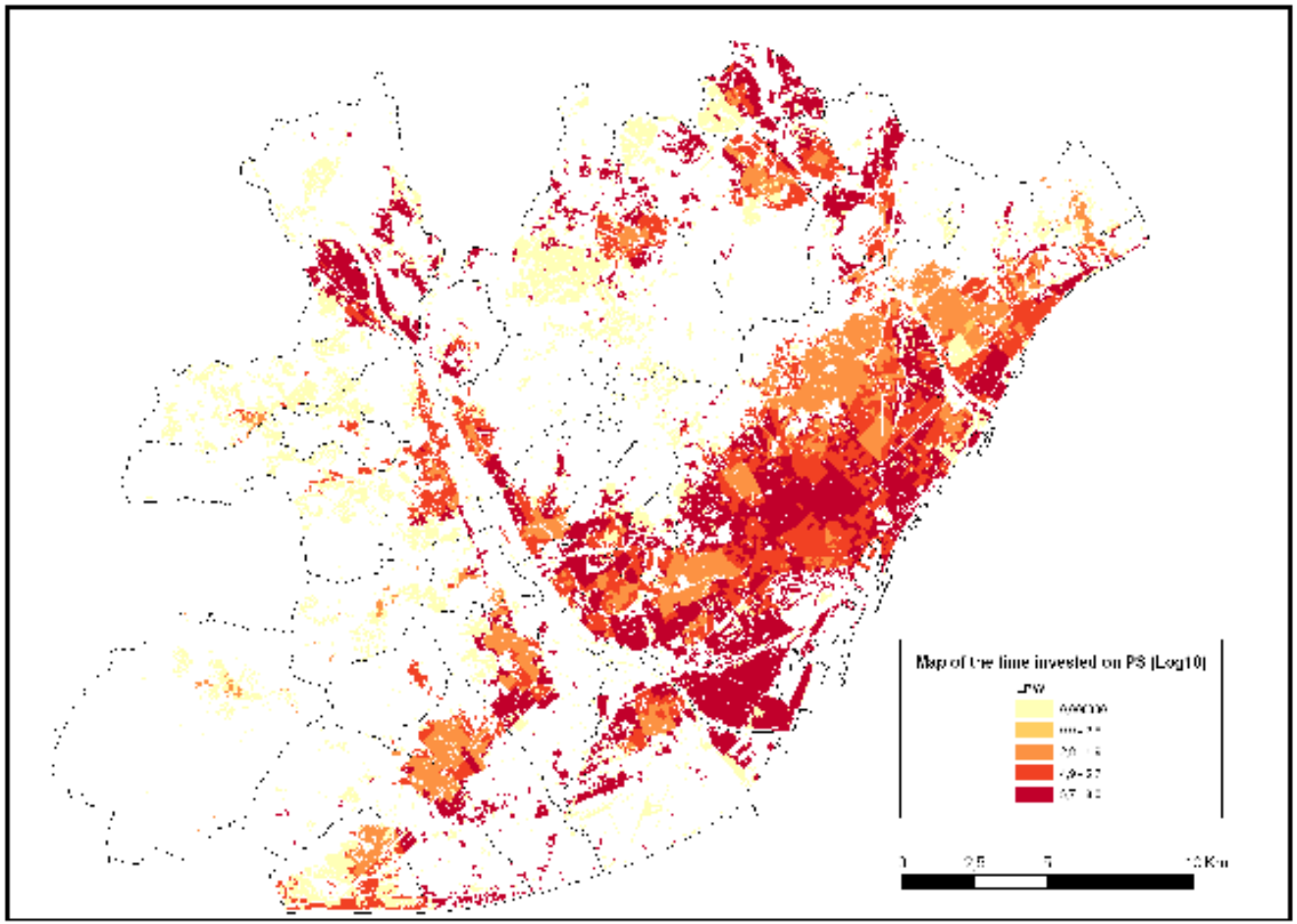


Figure A3. Map of the time invested on paid work in the productive sectors. Logarithmic scale.

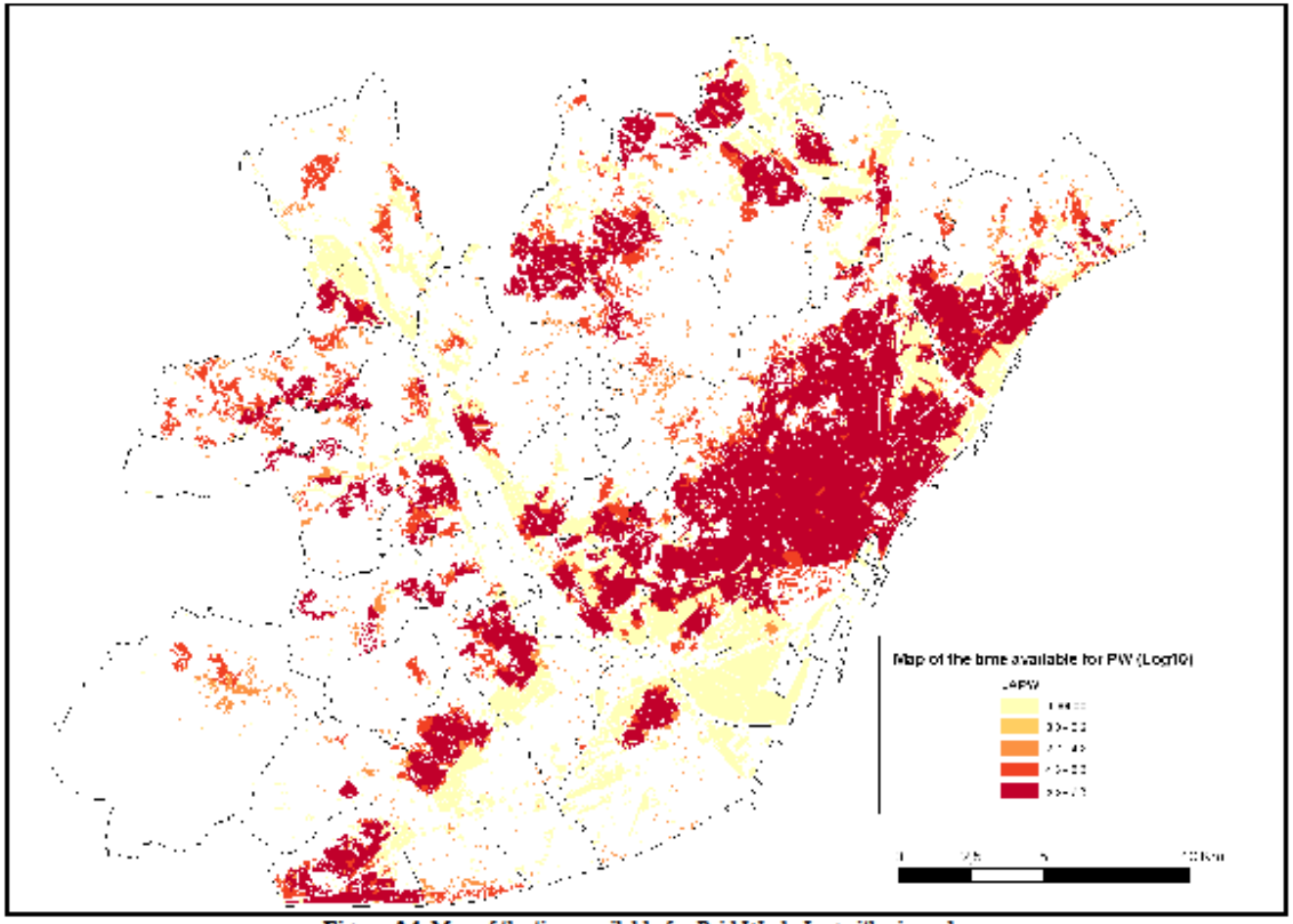


Figure A4. Map of the time available for Paid Work. Logarithmic scale.

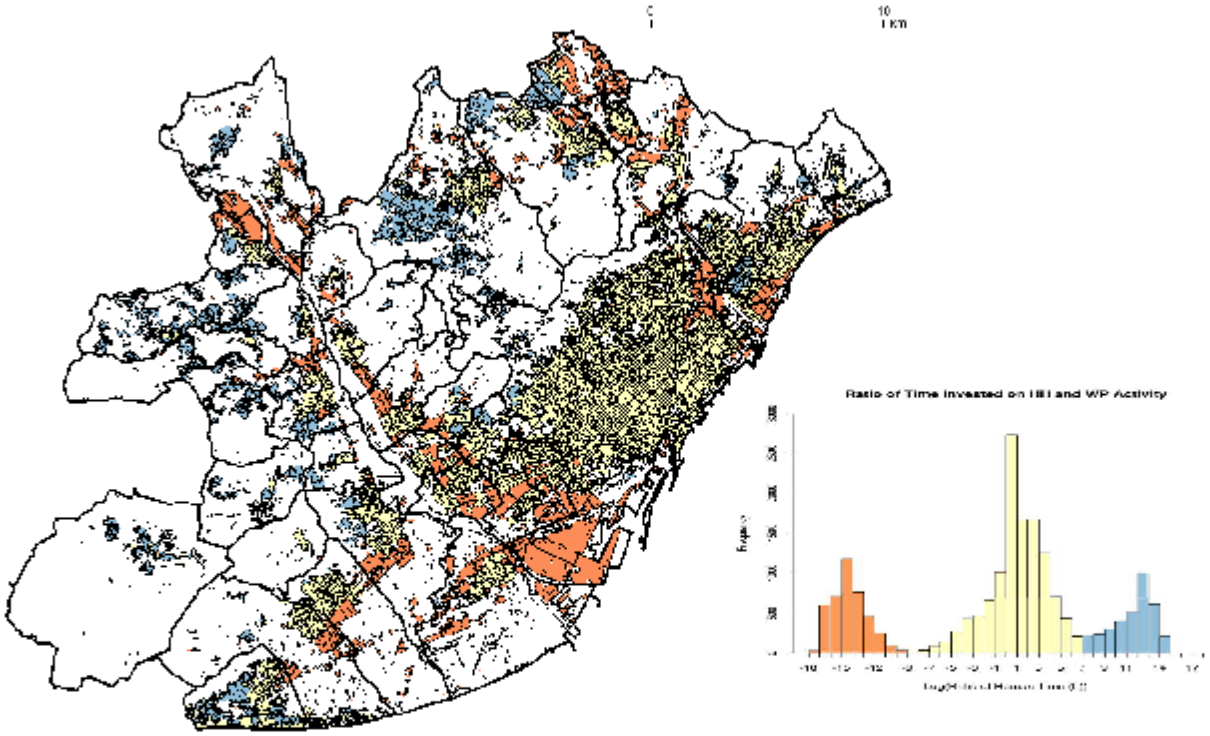


Figure A7. Map of the logarithm of the ratio of human time devoted to household activities and to paid work in the productive sectors. Colors identify the three distributions described by the histogram.

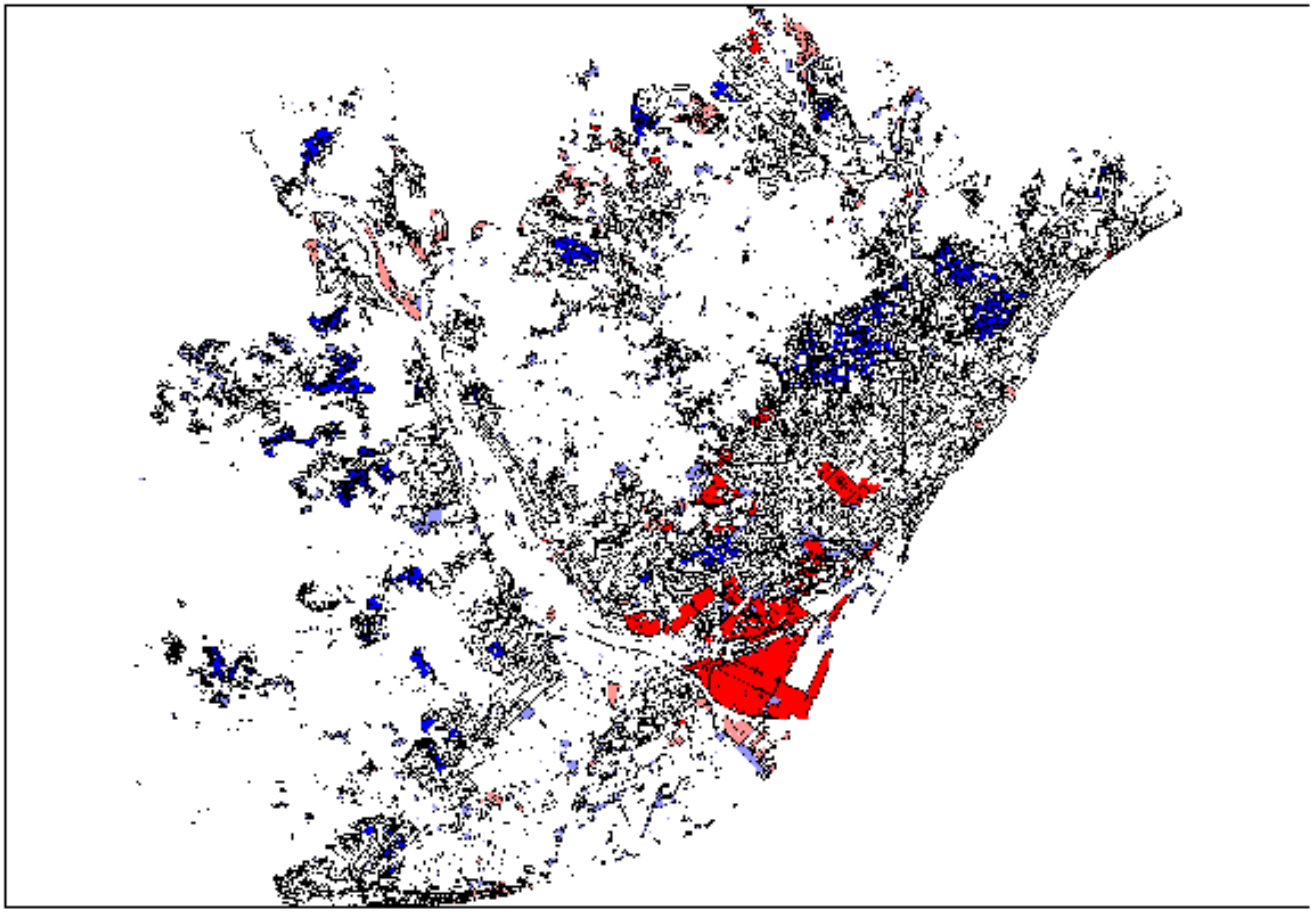


Figure A8. Clusters (LISA) of human time devoted to paid work in the productive sectors. Red, clusters of high values; blue, clusters of low values

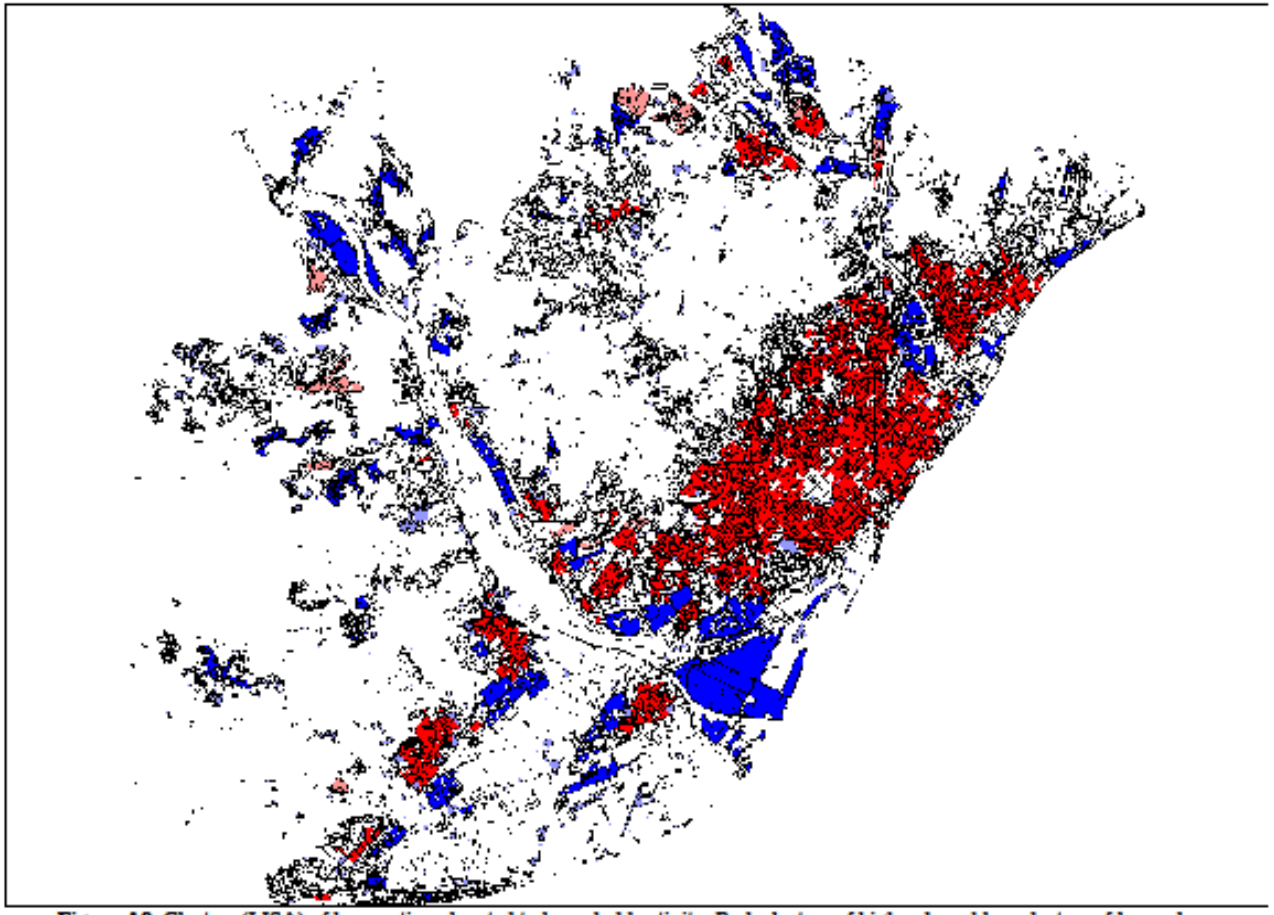


Figure A9. Clusters (LISA) of human time devoted to household activity. Red, clusters of high values; blue, clusters of low values.

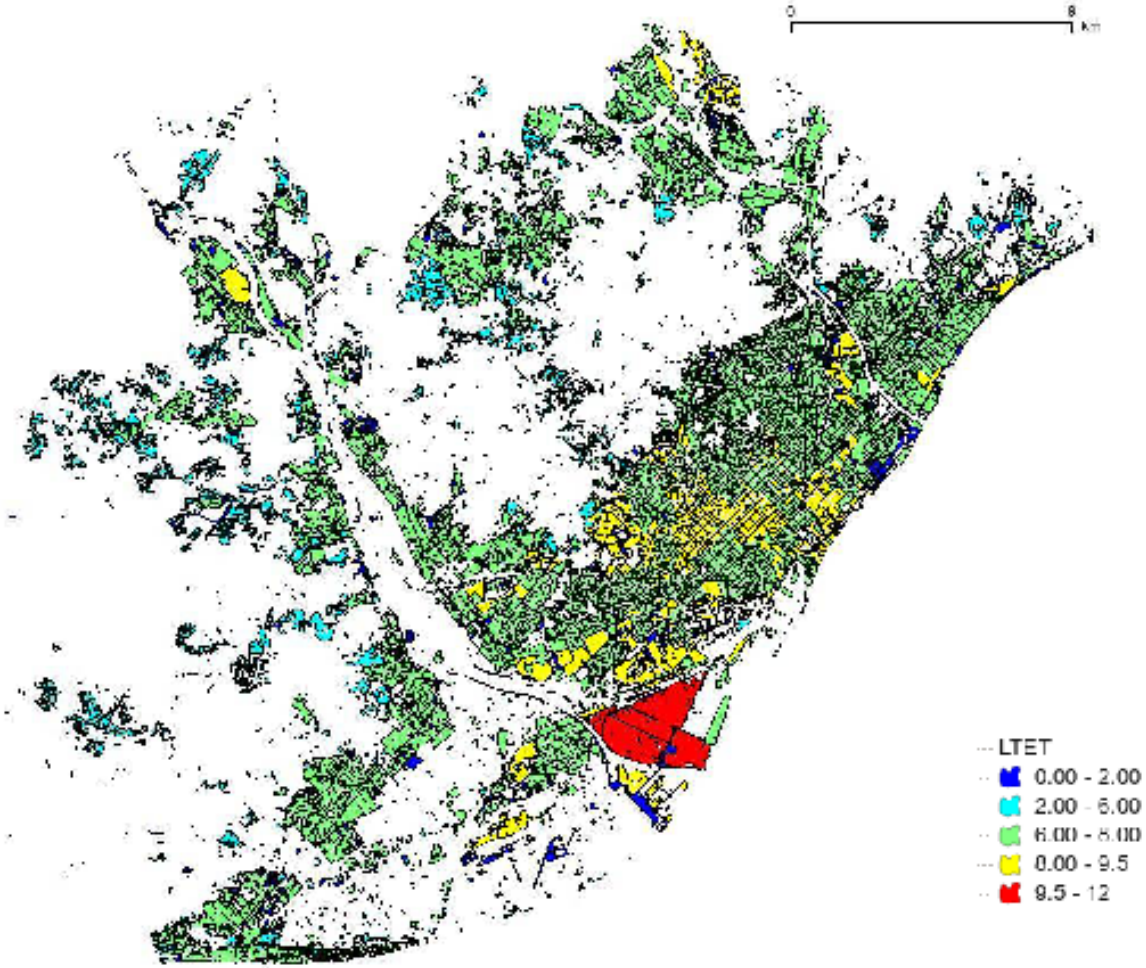


Figure A10. Map of Total Energy Throughput (Log10(MJ))

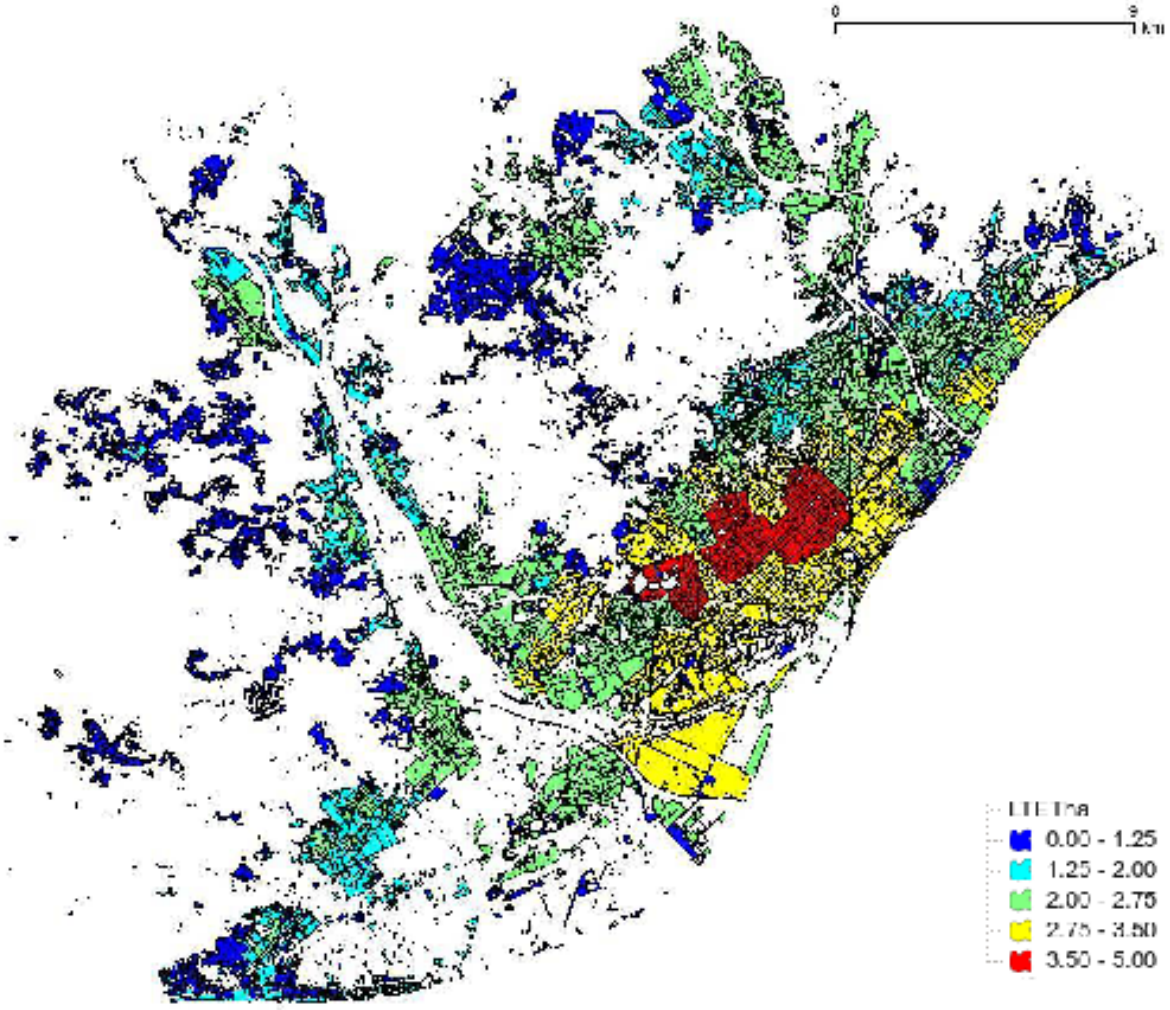


Figure A11. Map of Total Energy Throughput per ha (Log10(MJ/ha))

Examples of the hard work of Gonzalo

LEVEL OF ECONOMIC SECTORS – *level n-1*

Household Sector

Paid Work Sector

Leisure&Education

HH

Household Chores

Physiological Overhead

Size 52,1 Gh

Supply of hours for Paid Work

6,57 Gh

Services

Products

Food

Service & Government - SG

PW *Size* 6,57 Gh

Building & Manufacturing - BM
Energy & Mining - EM
PS

Agriculture - AG

HA_{HH}

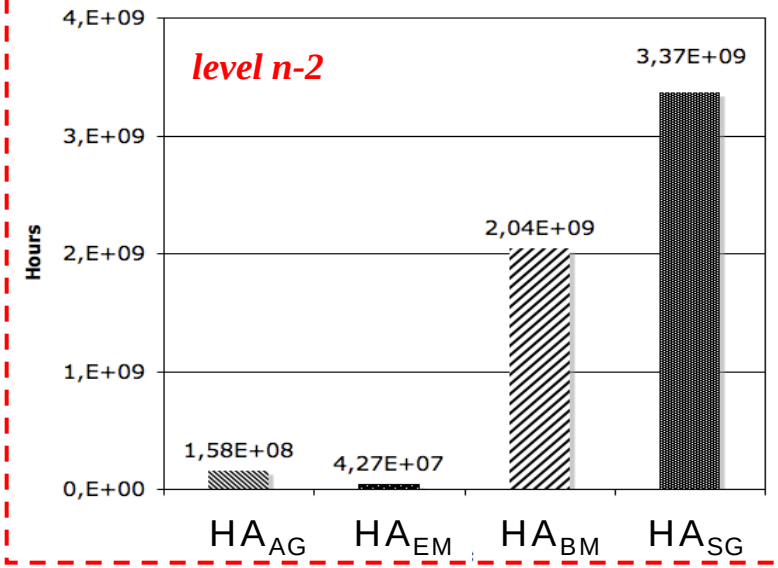
HA_{PW}

HA_{PW}

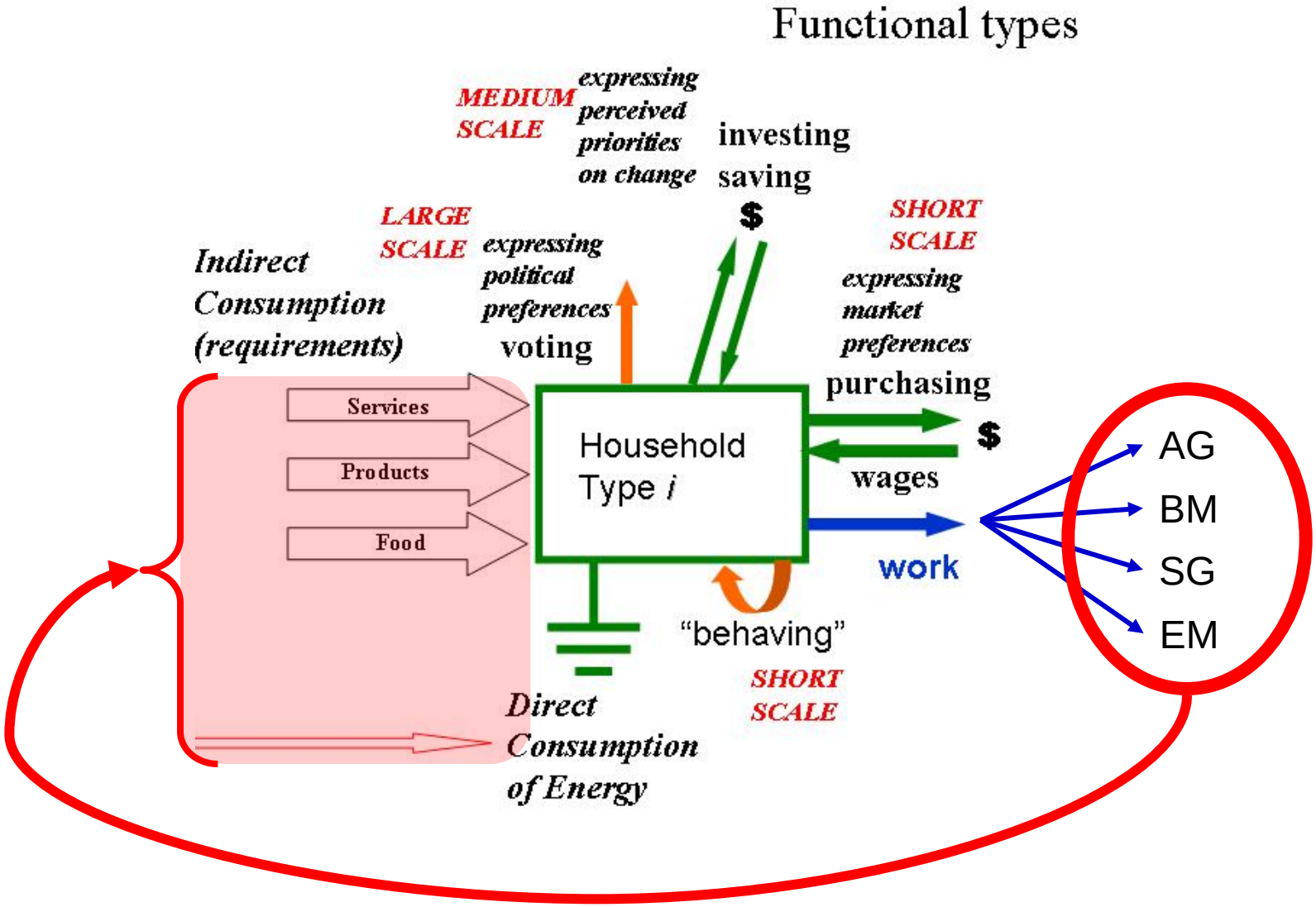
Requirement of hours for Paid Work
Catalonia, 2006

LEVEL OF THE WHOLE SOCIOECONOMIC SYSTEM
level n

Characteristics of the SOCIETAL METABOLISM
→ Average Society (THA)



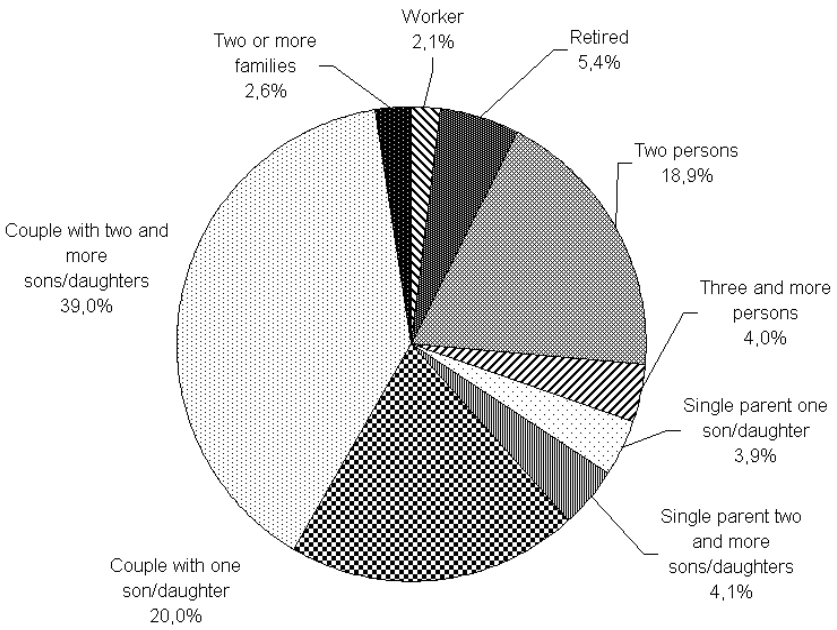
Household typologies (level n-2)



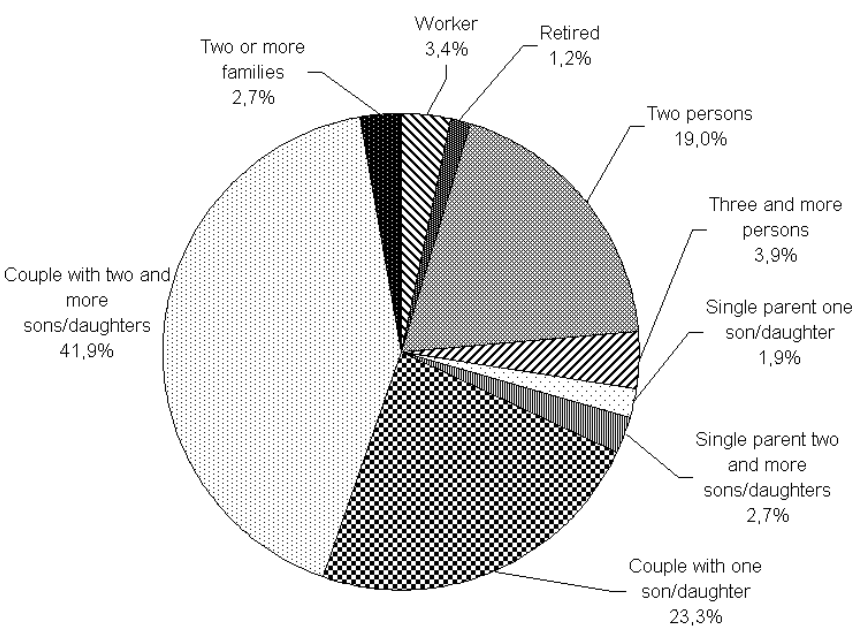
Number of people, by age categories, per HH typology

		Household typology									
Sex	Age category	Worker	Retired	Two persons	Three and more persons	Single parent one son/daughter	Single parent two and more sons/daughters	Couple with one son/daughter	Couple with two and more sons/daughters	Two or more families	Total
Men	< 15	0	0	0	6.340	4.076	14.944	98.267	372.688	21.510	517.824
	15to24	2.430	0	4.859	9.718	11.338	30.775	81.797	232.432	12.958	386.307
	25to44	70.739	0	207.502	46.570	33.012	27.706	339.549	487.513	21.222	1.233.814
	45to64	42.942	0	157.092	44.573	11.959	13.046	207.644	315.270	22.286	814.811
	65 and more	0	41.545	281.682	27.392	6.391	5.022	72.133	31.957	16.435	482.558
	Total	**116.111**	**41.545**	**651.136**	**134.593**	**66.775**	**91.493**	**799.389**	**1.439.861**	**94.411**	**3.435.314**
Women	< 15	0	0	221	8.190	5.313	14.831	94.520	349.302	15.716	488.093
	15to24	783	0	15.651	7.826	11.738	29.737	68.082	219.116	13.303	366.236
	25to44	28.876	0	171.555	29.442	39.633	36.236	311.403	494.848	30.574	1.142.566
	45to64	42.462	0	207.279	35.198	44.696	46.372	189.401	258.122	21.789	845.320
	65 and more	0	190.258	269.620	59.390	35.214	17.870	39.418	46.251	10.511	668.531
	Total	**72.120**	**190.258**	**664.326**	**140.046**	**136.594**	**145.046**	**702.824**	**1.367.637**	**91.895**	**3.510.746**

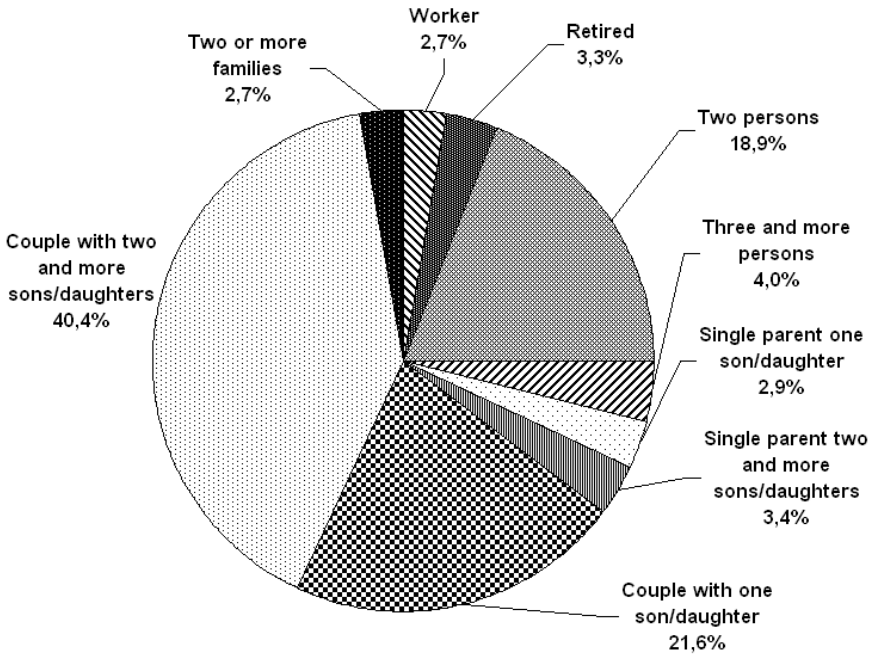
Women by HH Typology



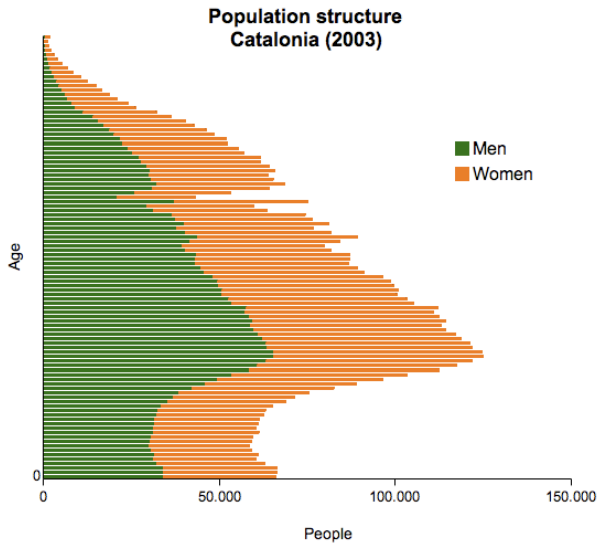
Men by HH Typology

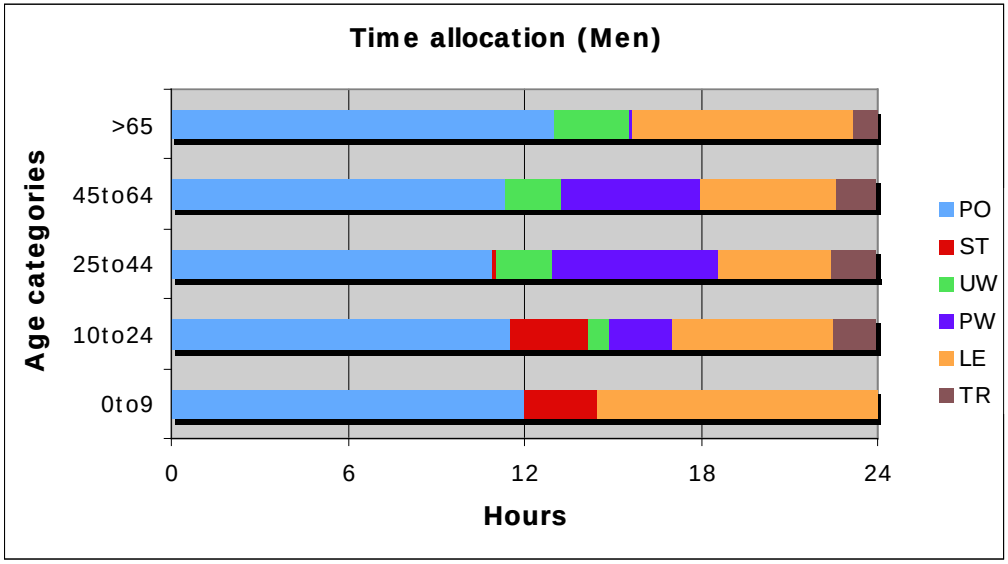


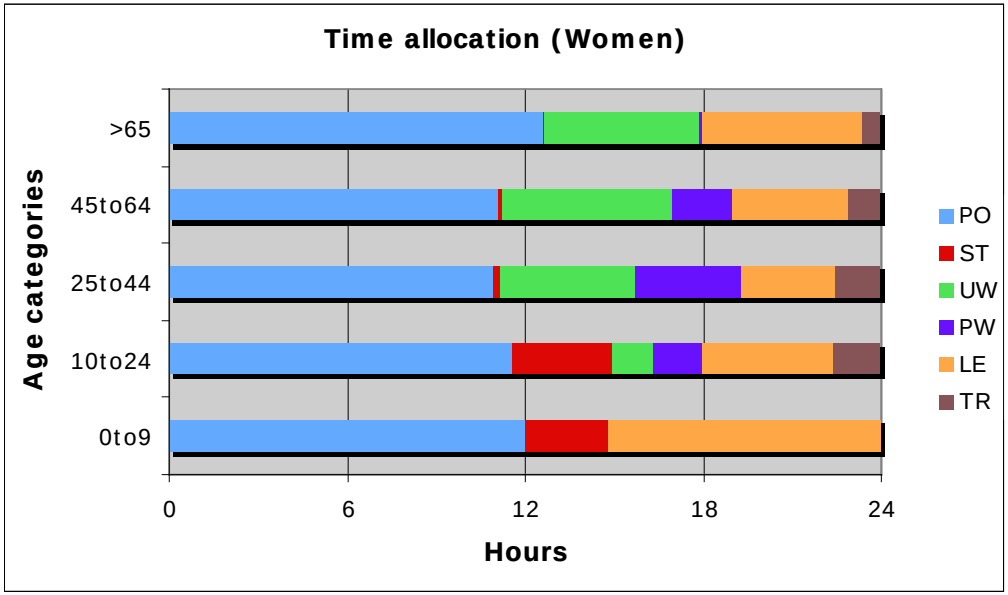
Total Population by HH Typology

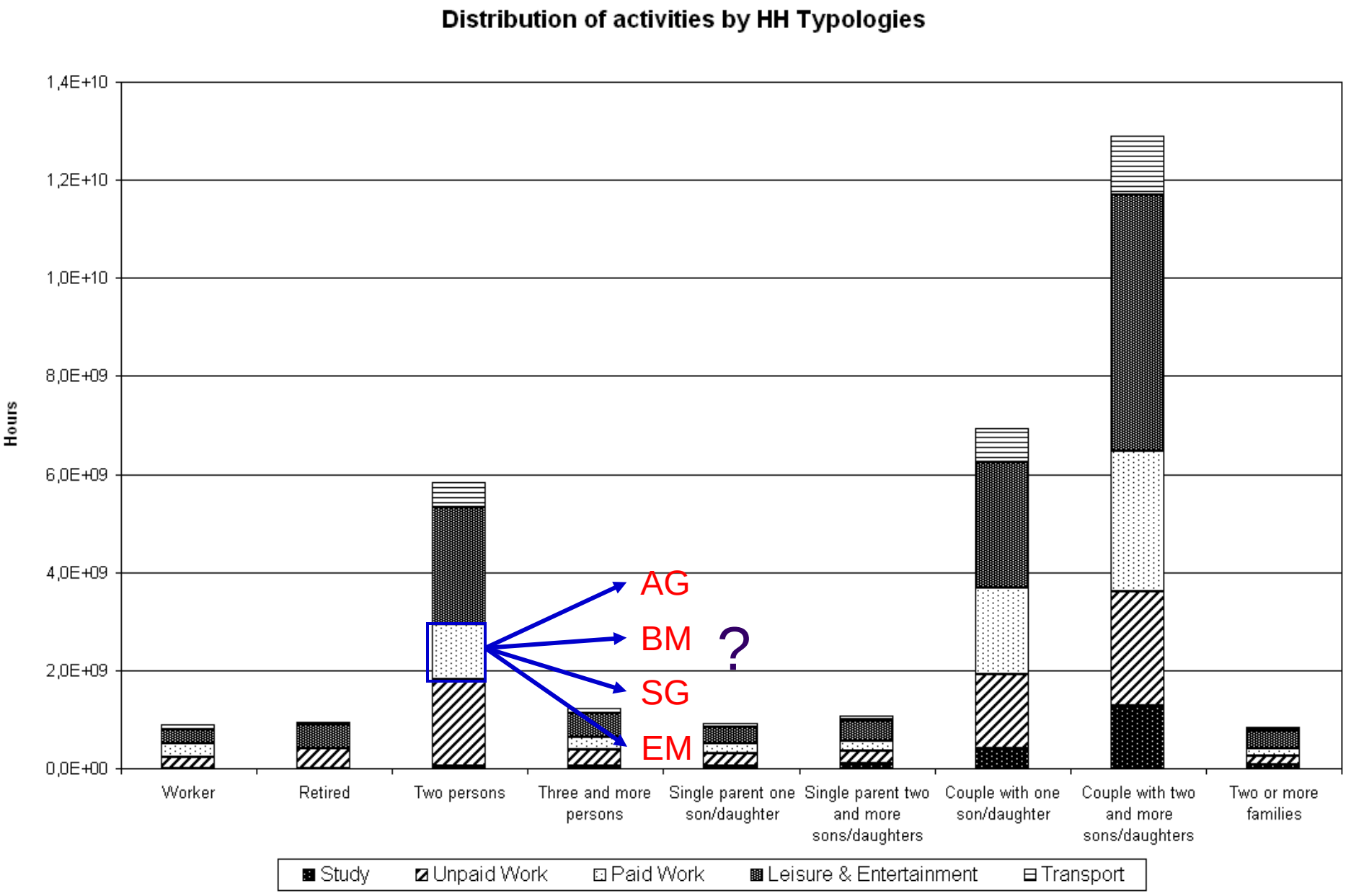


Level *n*-3. Use of Time of individuals

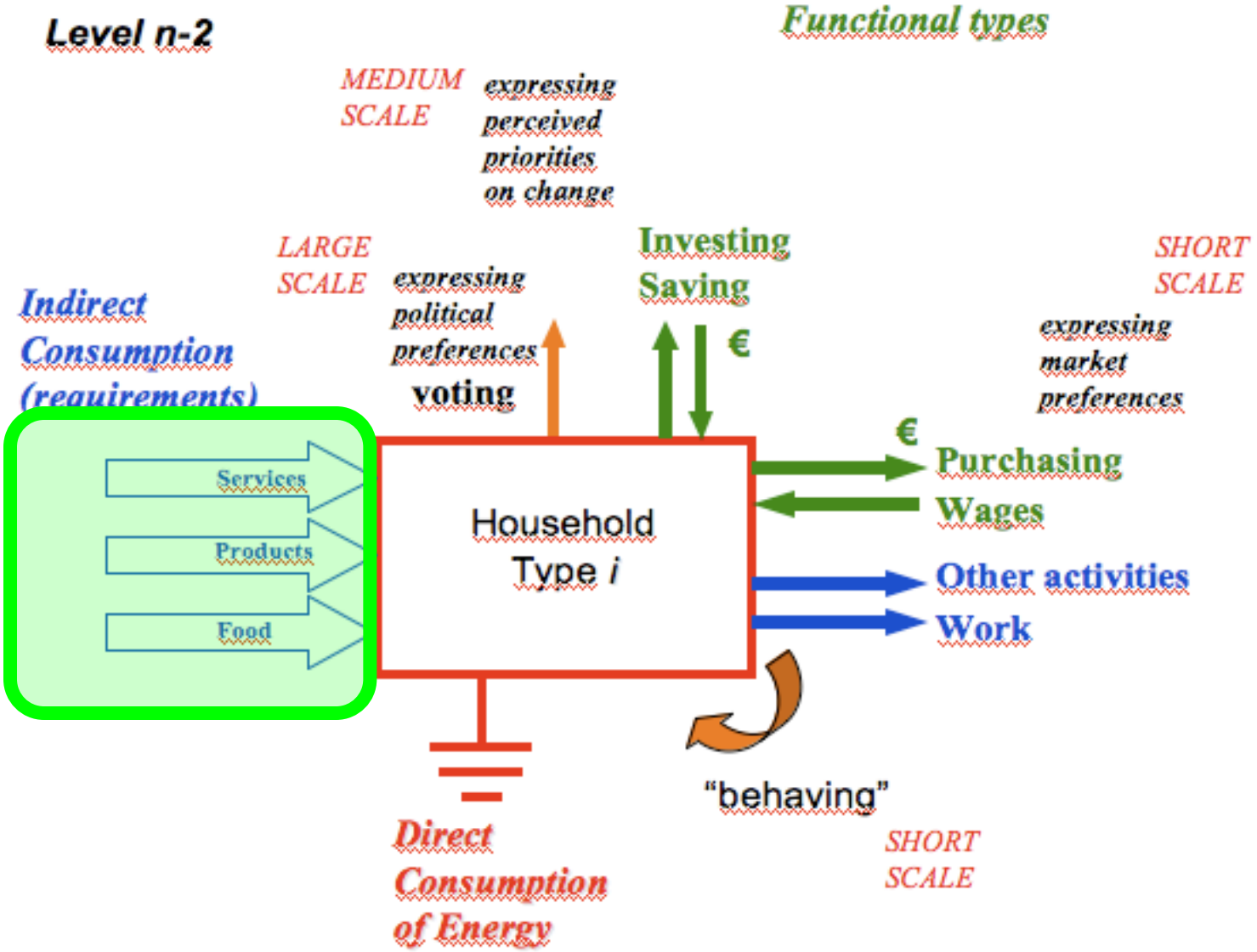







Distribution of activities by HH Typologies
Hours
1,4E+10
1,2E+10
1,0E+10
8,0E+09
6,0E+09
4,0E+09
2,0E+09
0,0E+00
AG
BM
?
SG
EM
Worker
Retired
Two persons
Three and more persons
Single parent one son/daughter
Single parent two and more sons/daughters
Couple with one son/daughter
Couple with two and more sons/daughters
Two or more families
Study
Unpaid Work
Paid Work
Leisure & Entertainment
Transport

Household typologies (level n-2)



"Consumption" of HA_{SG}

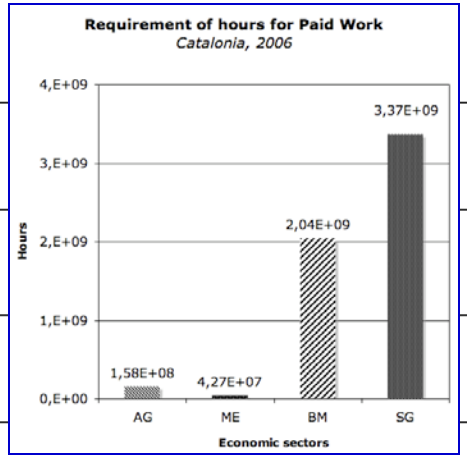
Health

	Age categories	Thousand of visits year	% of visits	HA_{HEALTH}	Population	Consumption HA_{HEALTH} p.c. Year
Men	<15	2.663	7,2%	23.001.280	517.824	44,4
	15to24	965	2,6%	8.332.693	386.307	21,6
	25to44	4.026	10,8%	34.778.666	1.233.814	28,2
	45to64	4.366	11,7%	37.711.924	814.811	46,3
	>64	4.218	11,3%	36.438.607	482.558	75,5
Women	<15	2.413	6,5%	20.848.703	488.093	42,7
	15to24	1.466	3,9%	12.665.583	366.236	34,6
	25to44	5.930	16,0%	51.227.294	1.142.566	44,8
	45to64	5.665	15,2%	48.935.758	845.320	57,9
	>64	5.464	14,7%	47.204.371	668.531	70,6
		37.176	100,0%	321.144.878	6.946.060	

Education

	Age categories	Time allocated to Study [h/day]	Population	HA_{ST}	% Total HA_{ST}	HA_{ED} [h/year]	Consumption HA_{ED} p.c. Year
Men	<15	2,5	517.824	1.312.728	23,6%	71.214.971	138
	15to24	2,6	386.307	1.016.953	18,3%	55.169.295	143
	25to44	0,1	1.233.814	176.435	3,2%	9.571.549	8
	45to64	0,0	814.811	13.689	0,2%	742.613	1
	>64	0,0	482.558	9.329	0,2%	506.119	1
Women	<15	3,0	488.093	1.448.508	26,0%	78.580.966	161
	15to24	3,3	366.236	1.213.084	21,8%	65.809.286	180
	25to44	0,2	1.142.566	271.816	4,9%	14.745.932	13
	45to64	0,1	845.320	78.108	1,4%	4.237.304	5
	>64	0,0	668.531	29.950	0,5%	1.624.786	2
				5.570.601	100,0%	302.202.819	

Overall "consumption" of HAsg by Household typologies



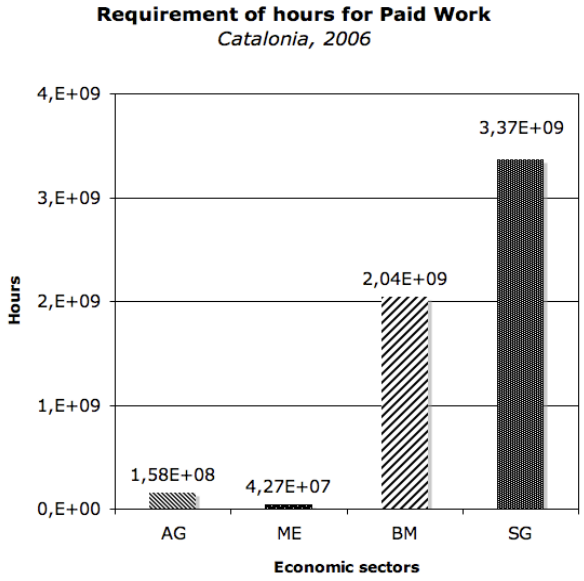
Hours

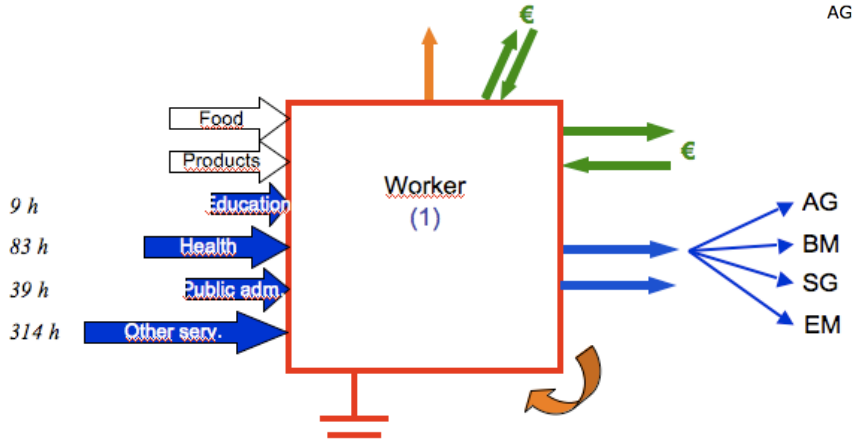
9,E+08
8,E+08
7,E+08
6,E+08
5,E+08
4,E+08
3,E+08
2,E+08
1,E+08
0,E+00

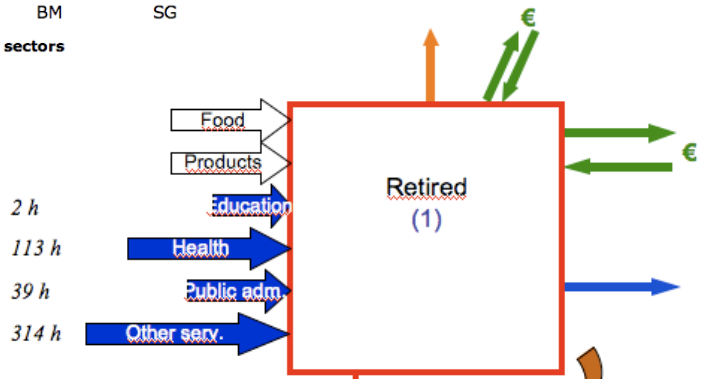
Worker
Retired
Two persons
Three and more persons
Single parent one son/daughter
Single parent two and more sons/daughters
Couple with one son/daughter
Couple with two and more sons/daughters
Two or more families

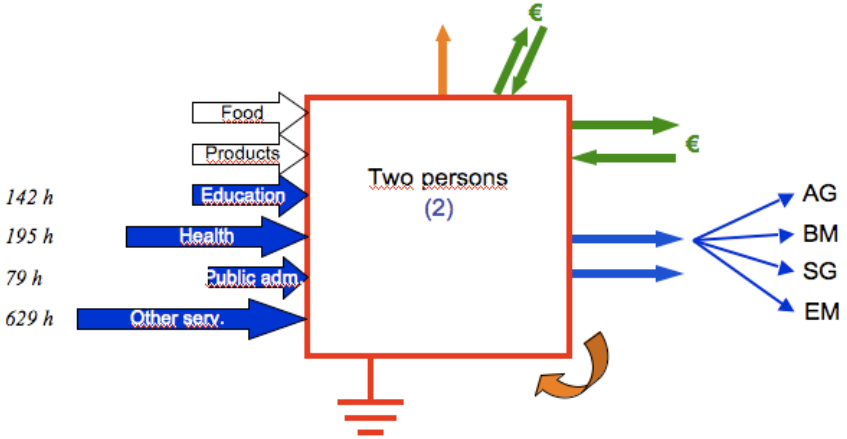
Education .Health & Personnel serv Public administration Other services

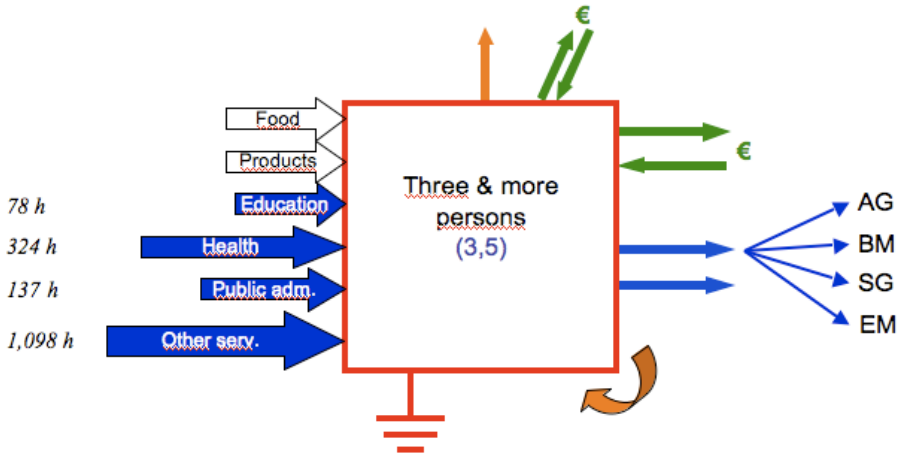
Use of time by HH Typologies

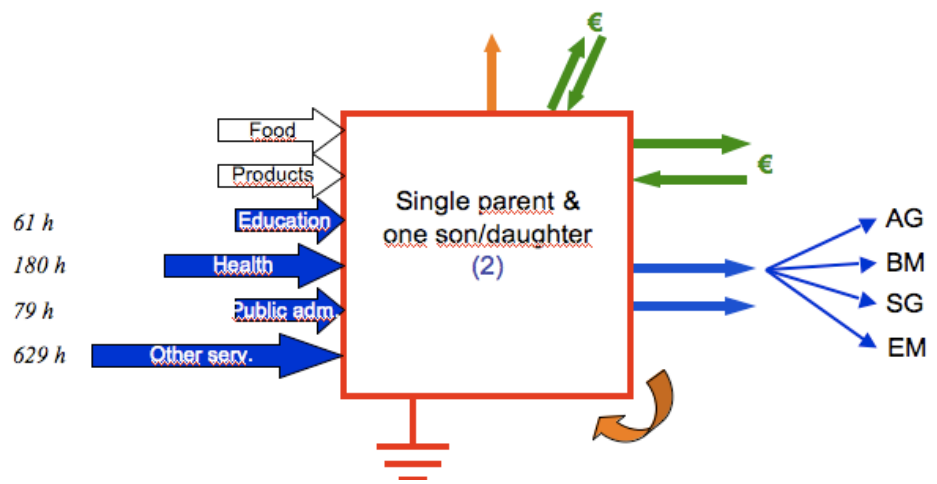


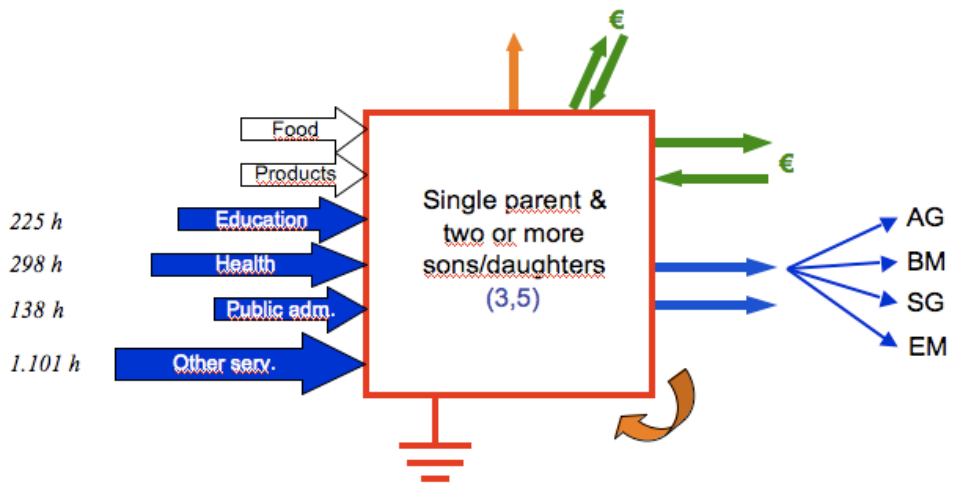


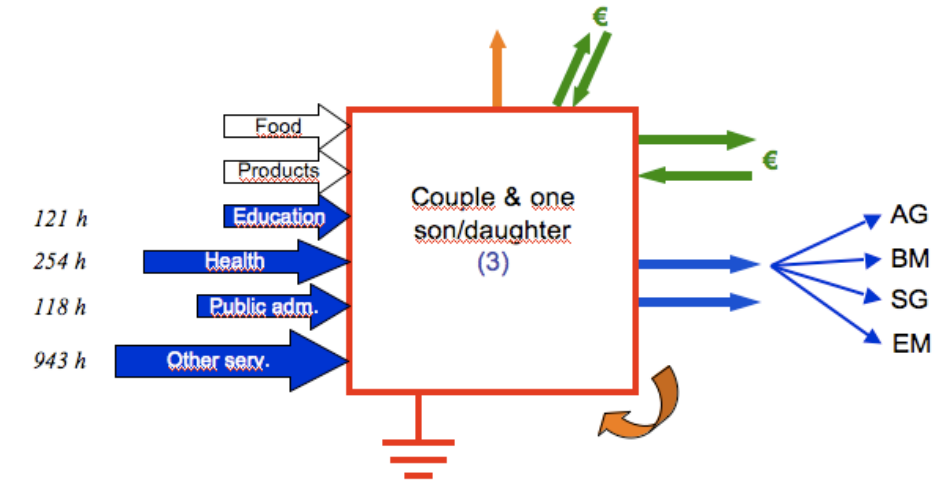


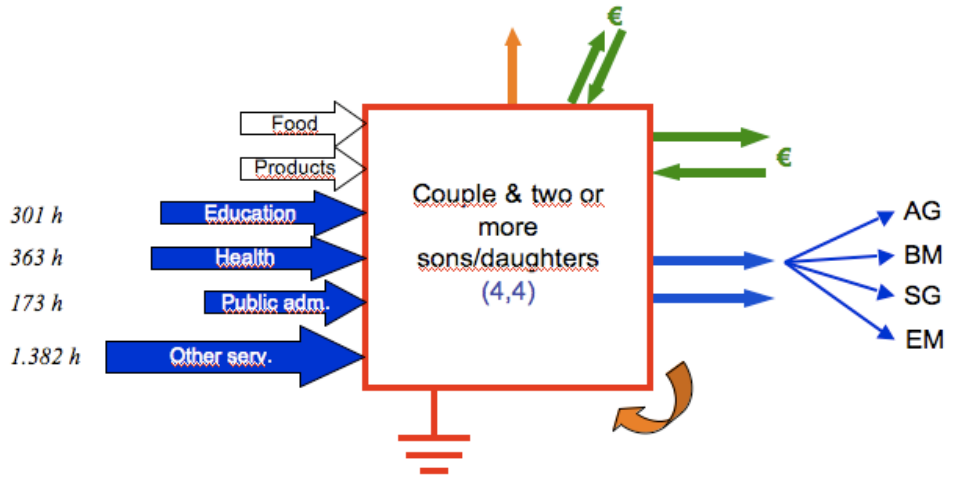


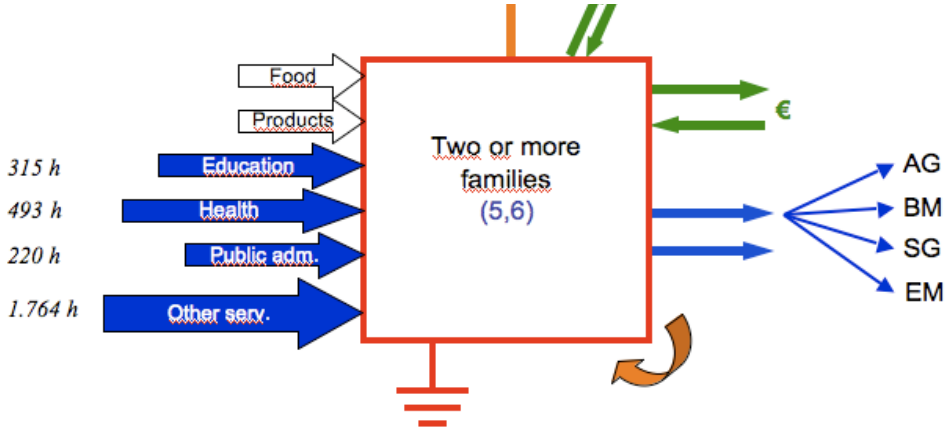


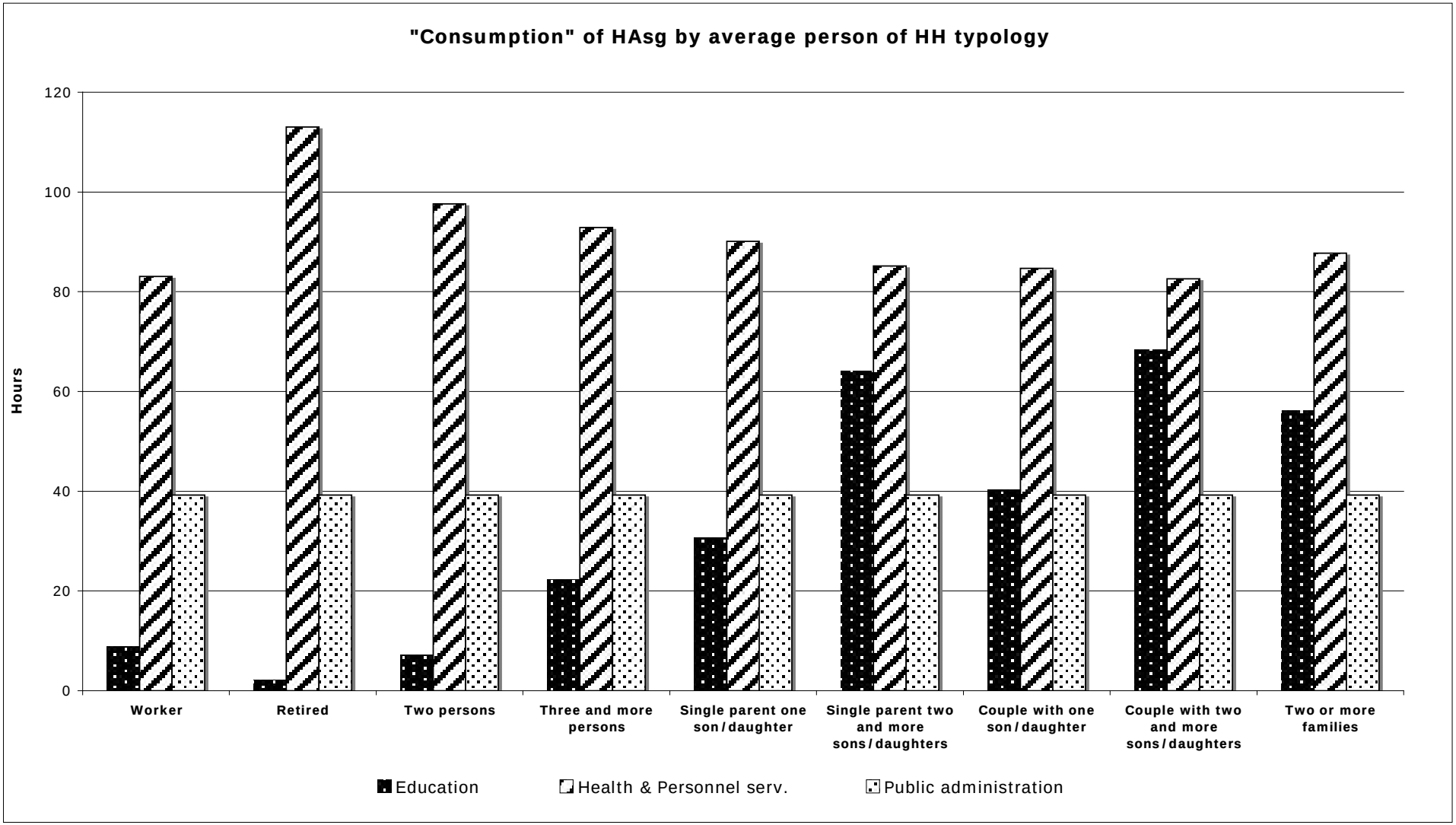

Food
Products
Education
Health
Public adm.
Other serv.
61 h
180 h
79 h
629 h
Single parent & one son/daughter (2)
€
€
AG
BM
SG
EM


Food
Products
Education
Health
Public adm.
Other serv.
225 h
298 h
138 h
1.101 h
Single parent & two or more sons/daughters (3,5)
€
€
AG
BM
SG
EM

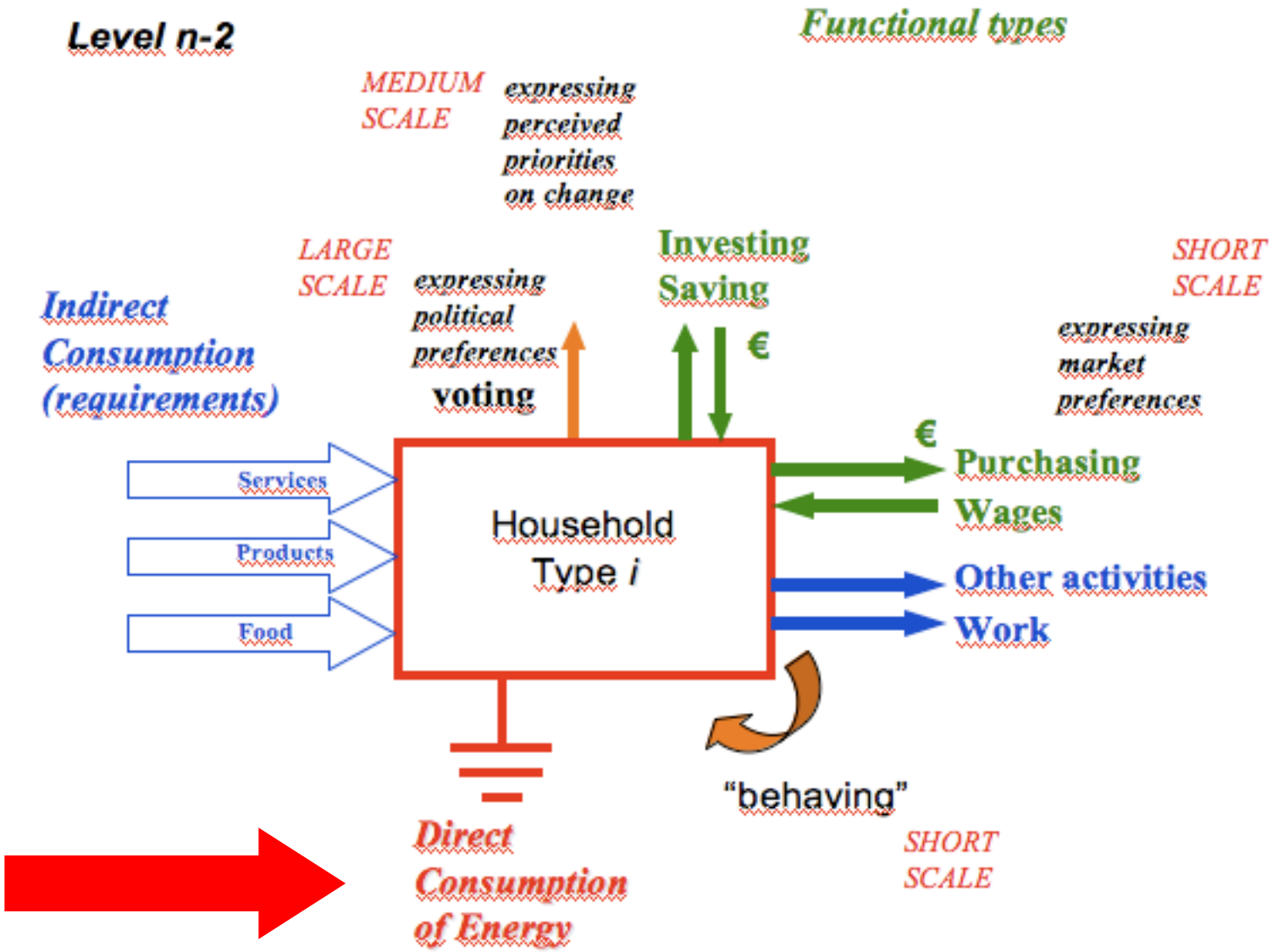

Food
Products
Education
Health
Public adm.
Other serv.
121 h
254 h
118 h
943 h
Couple & one son/daughter (3)
€
€
AG
BM
SG
EM


Food
Products
Education
Health
Public adm.
Other serv.
301 h
363 h
173 h
1.382 h
Couple & two or more sons/daughters (4,4)
€
€
AG
BM
SG
EM

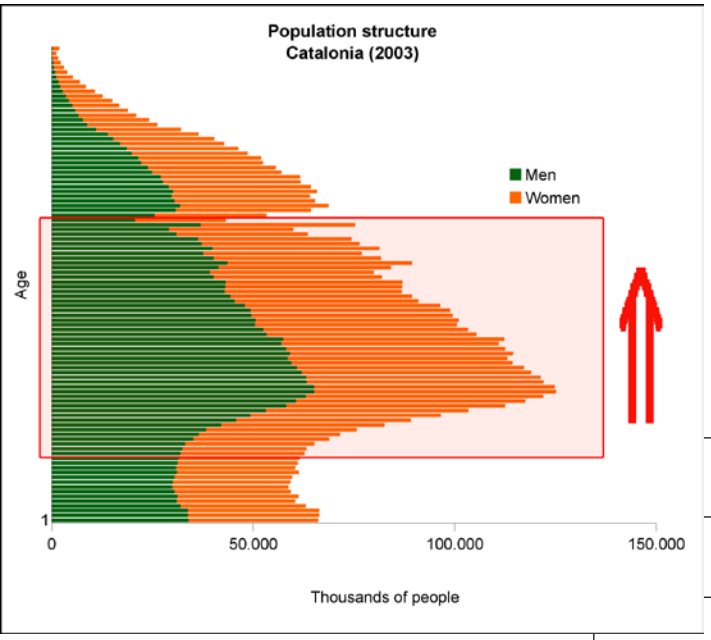

Food
Products
Education
Health
Public adm.
Other serv.
315 h
493 h
220 h
1.764 h
Two or more families (5,6)
€
AG
BM
SG
EM

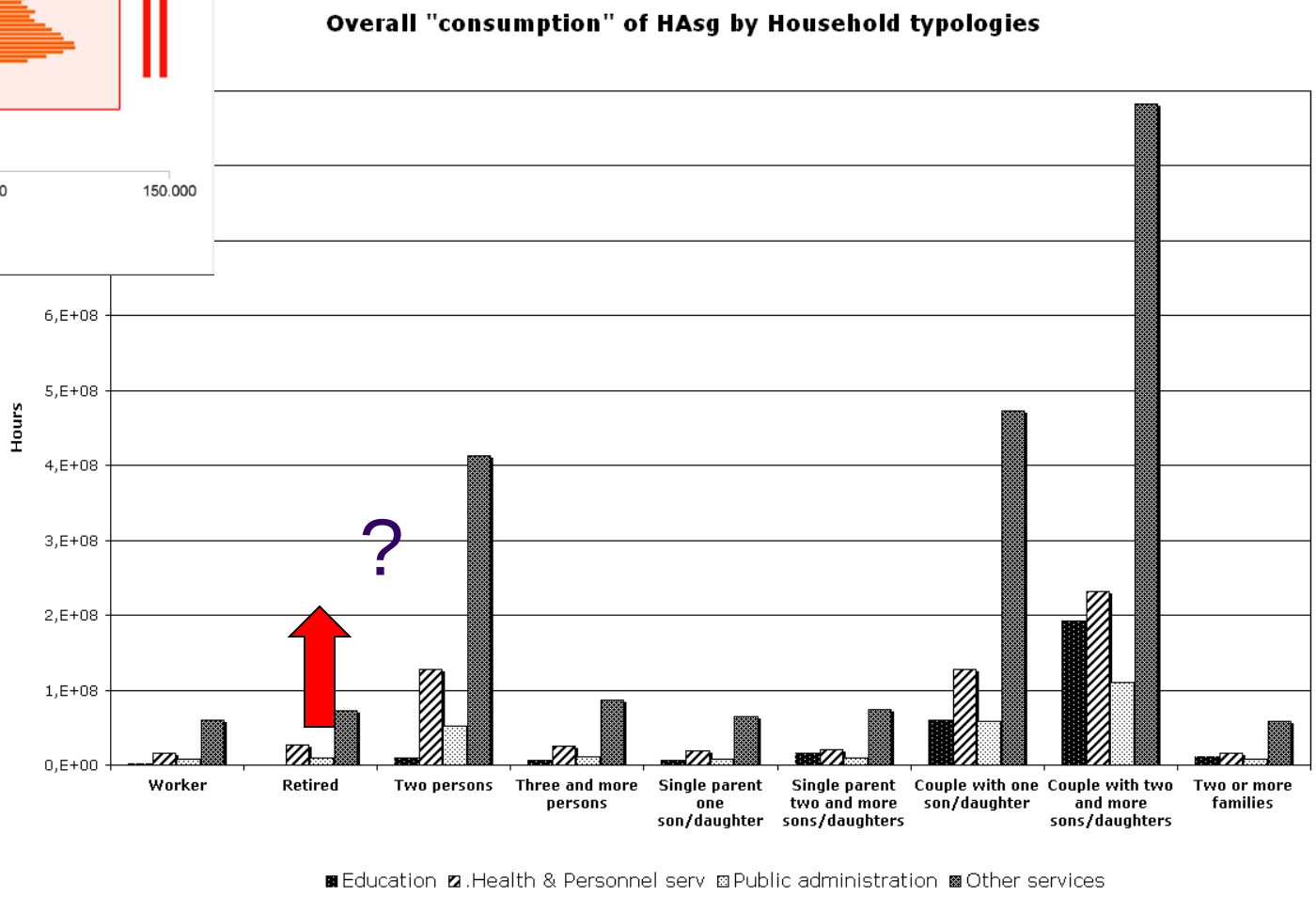

"Consumption" of HAsg by average person of HH typology
Hours
120
100
80
60
40
20
0
Worker
Retired
Two persons
Three and more persons
Single parent one son/daughter
Single parent two and more sons/daughters
Couple with one son/daughter
Couple with two and more sons/daughters
Two or more families
Education
Health & Personnel serv.
Public administration

Next steps (I)


Level n-2
Functional types
MEDIUM SCALE
expressing perceived priorities on change
LARGE SCALE
expressing political preferences
voting
Investing
Saving
€
SHORT SCALE
expressing market preferences
Indirect Consumption (requirements)
Services
Products
Food
Household Type i
€
Purchasing
Wages
Other activities
Work
"behaving"
SHORT SCALE
Direct Consumption of Energy

Next steps (II)





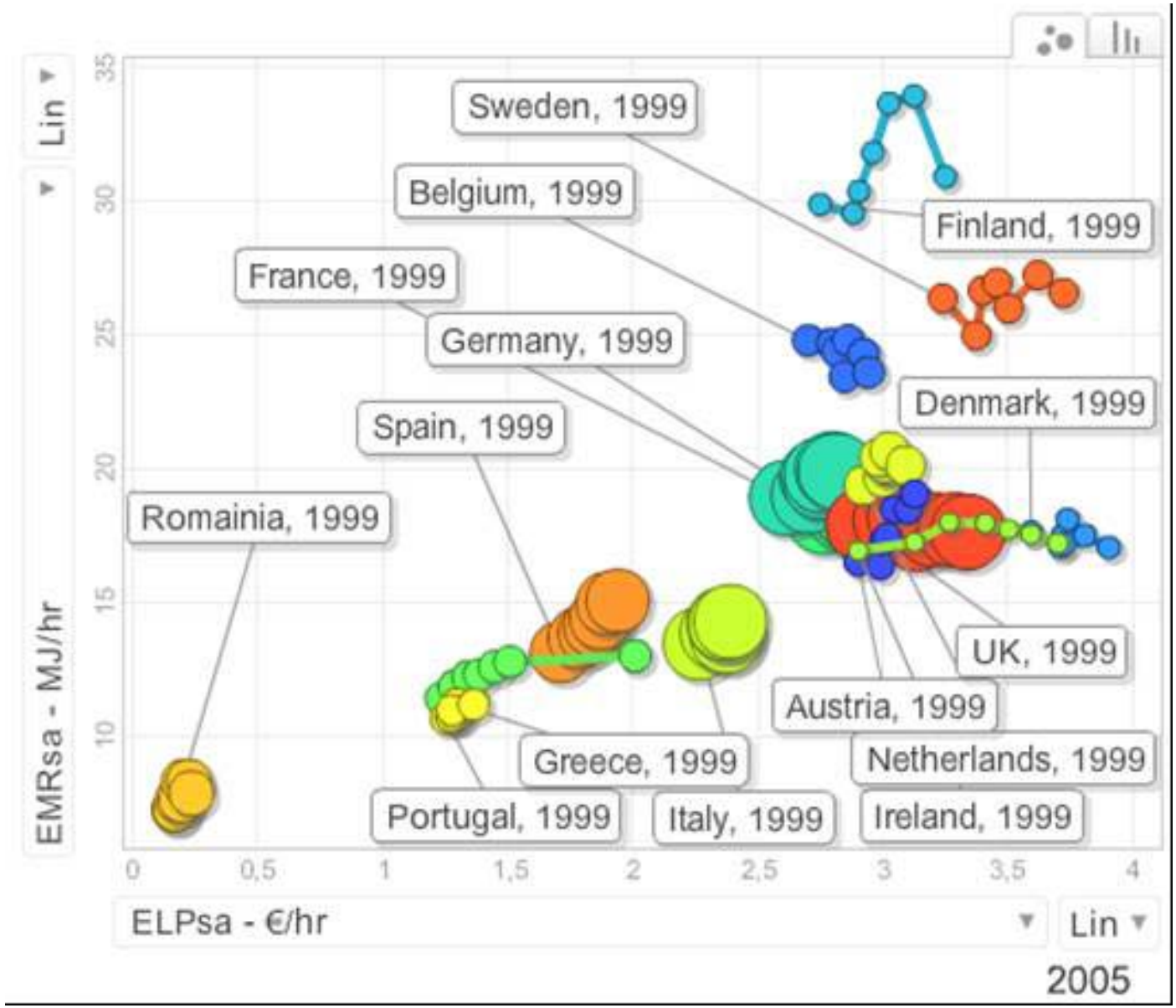
To end up Catalonia:

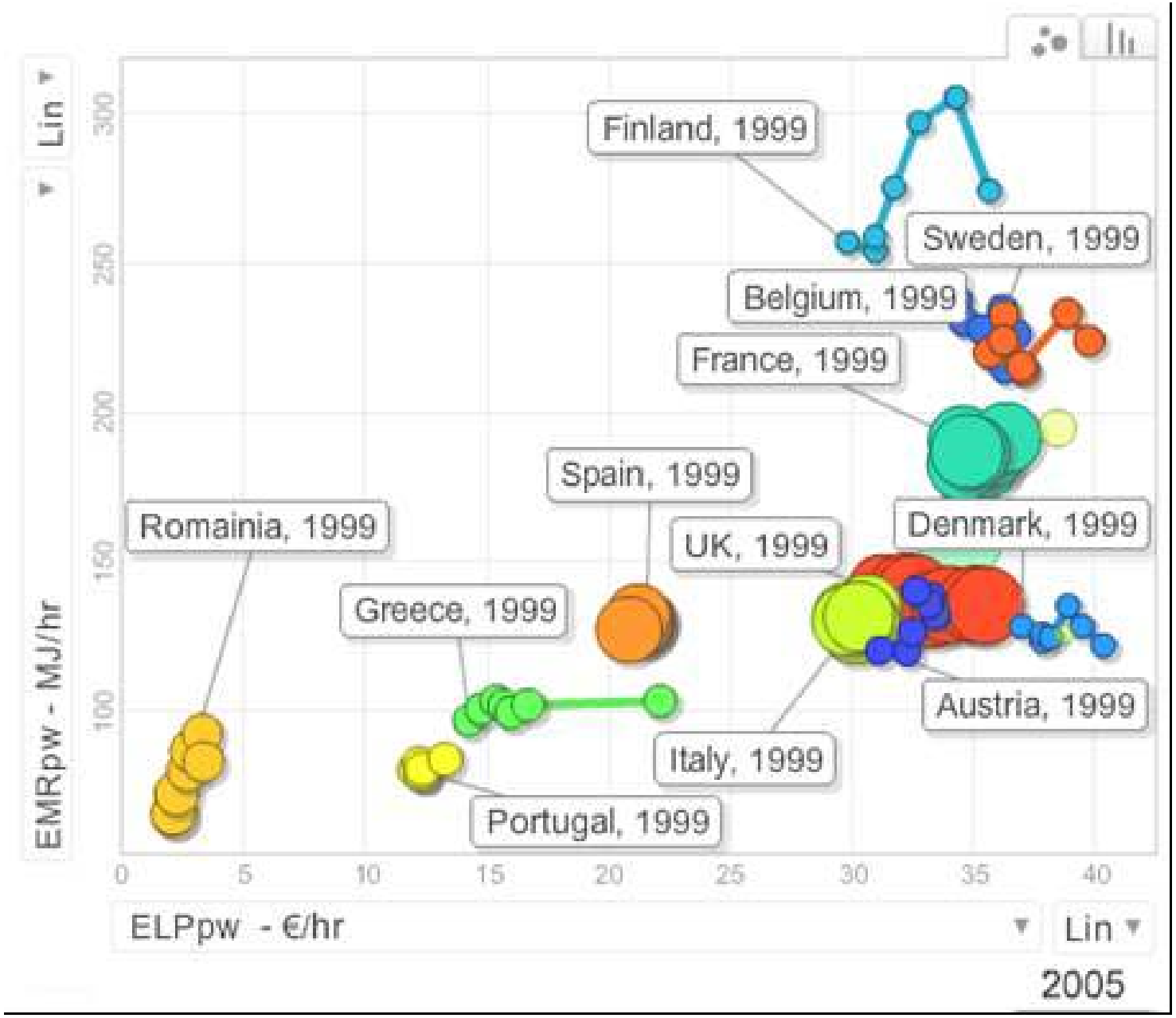
SUMMA ?

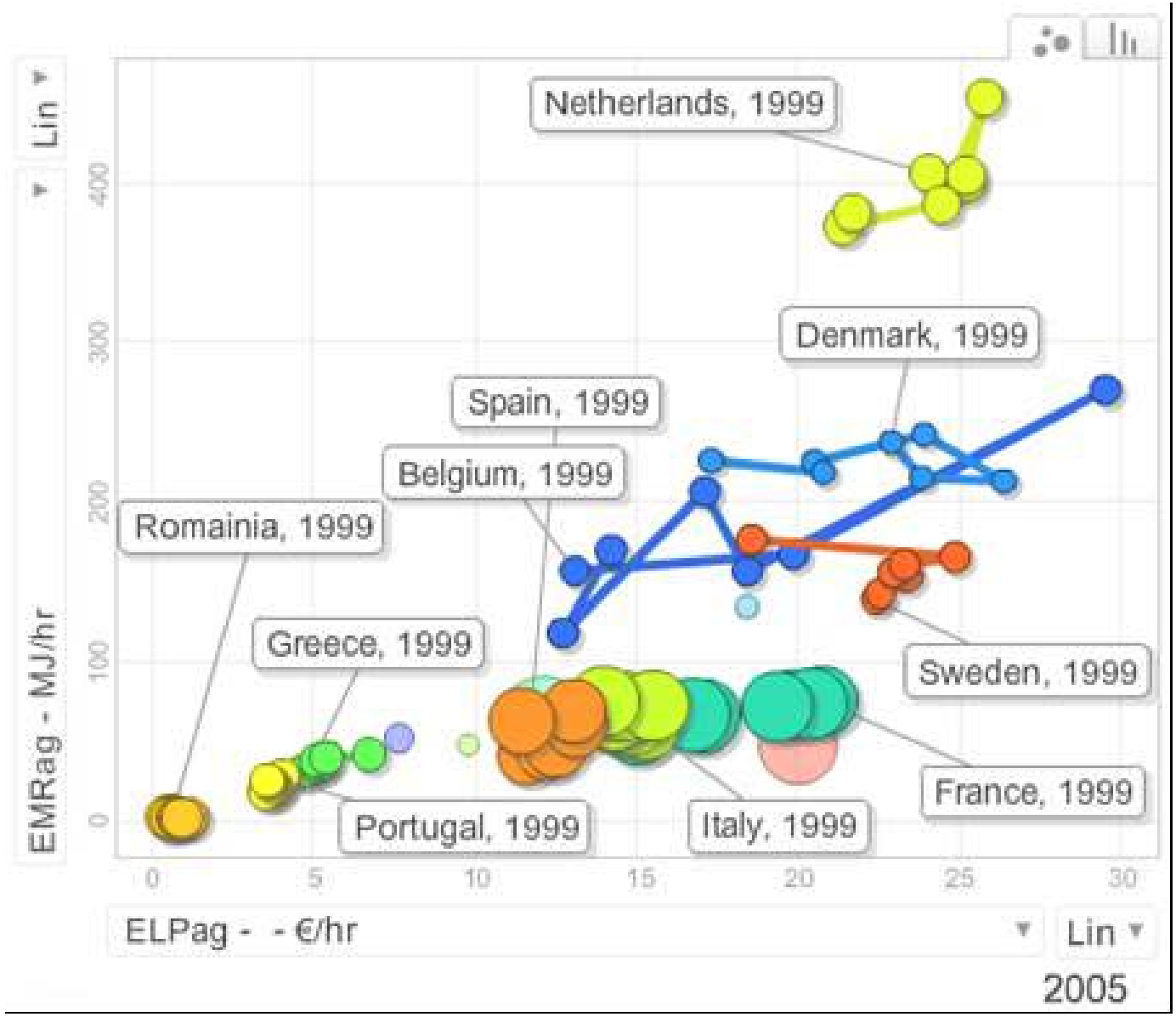
ASA decomposition analysis on energy intensity

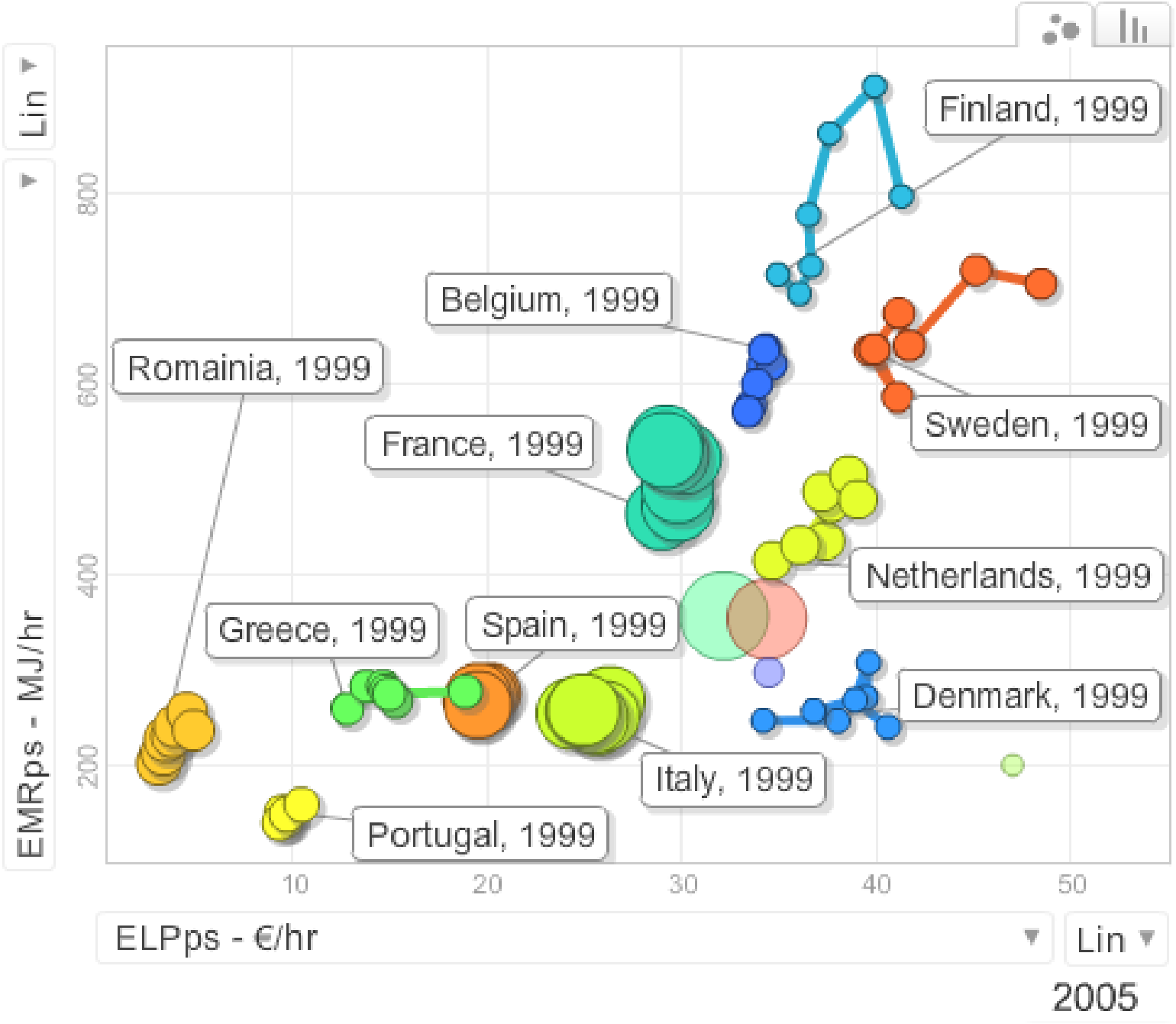
$$\frac{TET}{GDP} = \frac{THA}{GDP} \times \frac{HApw}{THA} \times \frac{ETpw}{HApw} \times \frac{TET}{ETpw}$$

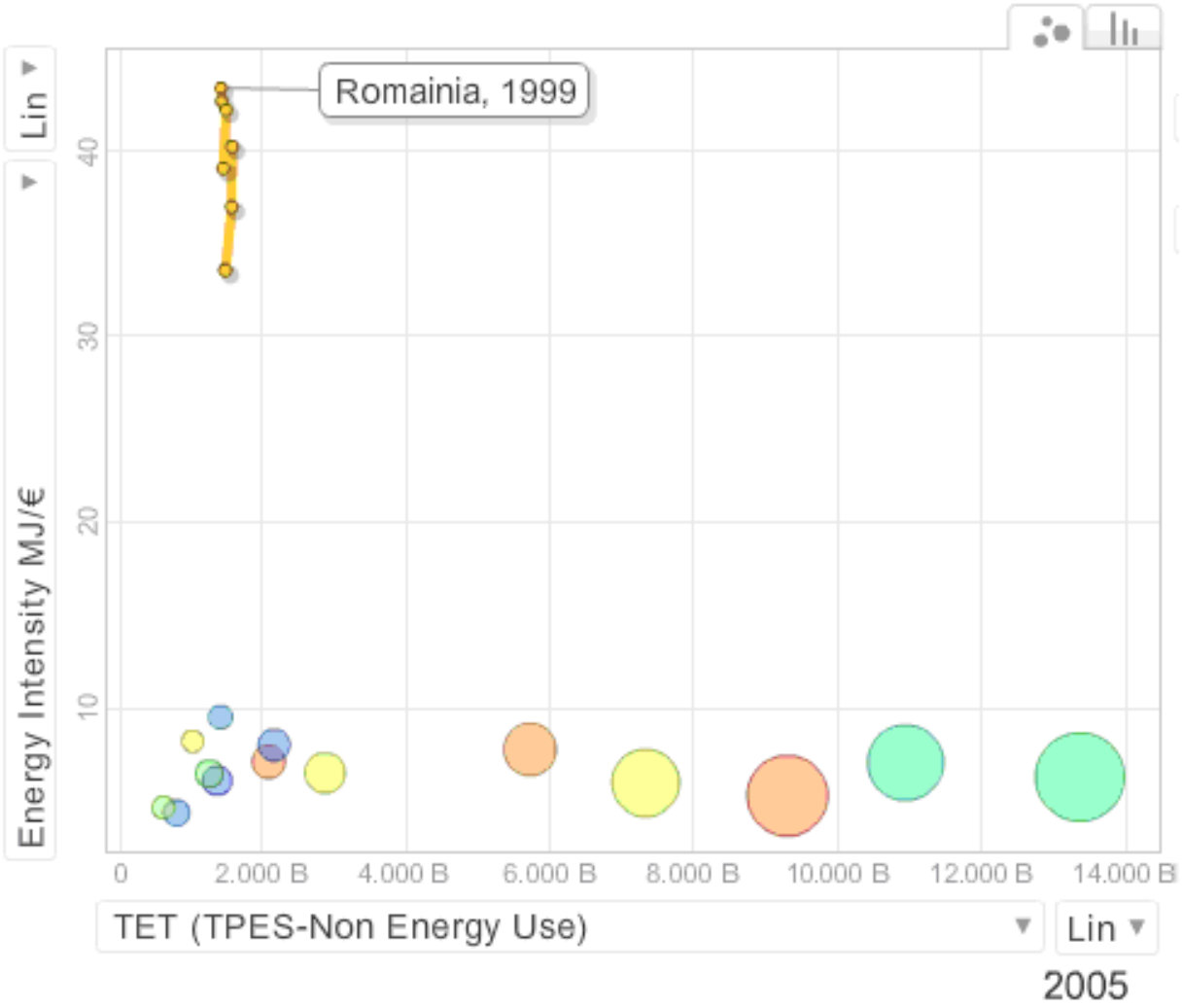
Examples of the hard work of
Alev (on Romania)


Lin
EMRsa - MJ/hr
35
30
25
20
15
10
Sweden, 1999
Belgium, 1999
France, 1999
Germany, 1999
Spain, 1999
Romainia, 1999
Finland, 1999
Denmark, 1999
UK, 1999
Austria, 1999
Netherlands, 1999
Greece, 1999
Portugal, 1999
Italy, 1999
Ireland, 1999
0
0,5
1
1,5
2
2,5
3
3,5
4
ELPsa - €/hr
Lin
2005


Lin
EMRpw - MJ/hr
300
250
200
150
100
Finland, 1999
Sweden, 1999
Belgium, 1999
France, 1999
Spain, 1999
Romainia, 1999
UK, 1999
Denmark, 1999
Greece, 1999
Austria, 1999
Italy, 1999
Portugal, 1999
0
5
10
15
20
25
30
35
40
ELPpw - €/hr
Lin
2005


Lin
EMRag - MJ/hr
0
100
200
300
400
Netherlands, 1999
Denmark, 1999
Spain, 1999
Belgium, 1999
Romainia, 1999
Greece, 1999
Sweden, 1999
France, 1999
Portugal, 1999
Italy, 1999
0
5
10
15
20
25
30
ELPag - - €/hr
Lin
2005


Lin
EMRps - MJ/hr
800
600
400
200
Finland, 1999
Belgium, 1999
Romainia, 1999
Sweden, 1999
France, 1999
Netherlands, 1999
Greece, 1999
Spain, 1999
Denmark, 1999
Italy, 1999
Portugal, 1999
10
20
30
40
50
ELPps - €/hr
Lin
2005


Romainia, 1999
Lin
Energy Intensity MJ/€
10
20
30
40
0
2.000 B
4.000 B
6.000 B
8.000 B
10.000 B
12.000 B
14.000 B
TET (TPES-Non Energy Use)
Lin
2005

To end up Romania:

Raluca made a comparison Bulgaria, Hungary, Romania

Raluca made an analysis in the service sector down to level n-3/n-4

Lucien wrote a paper on black economy and emigration

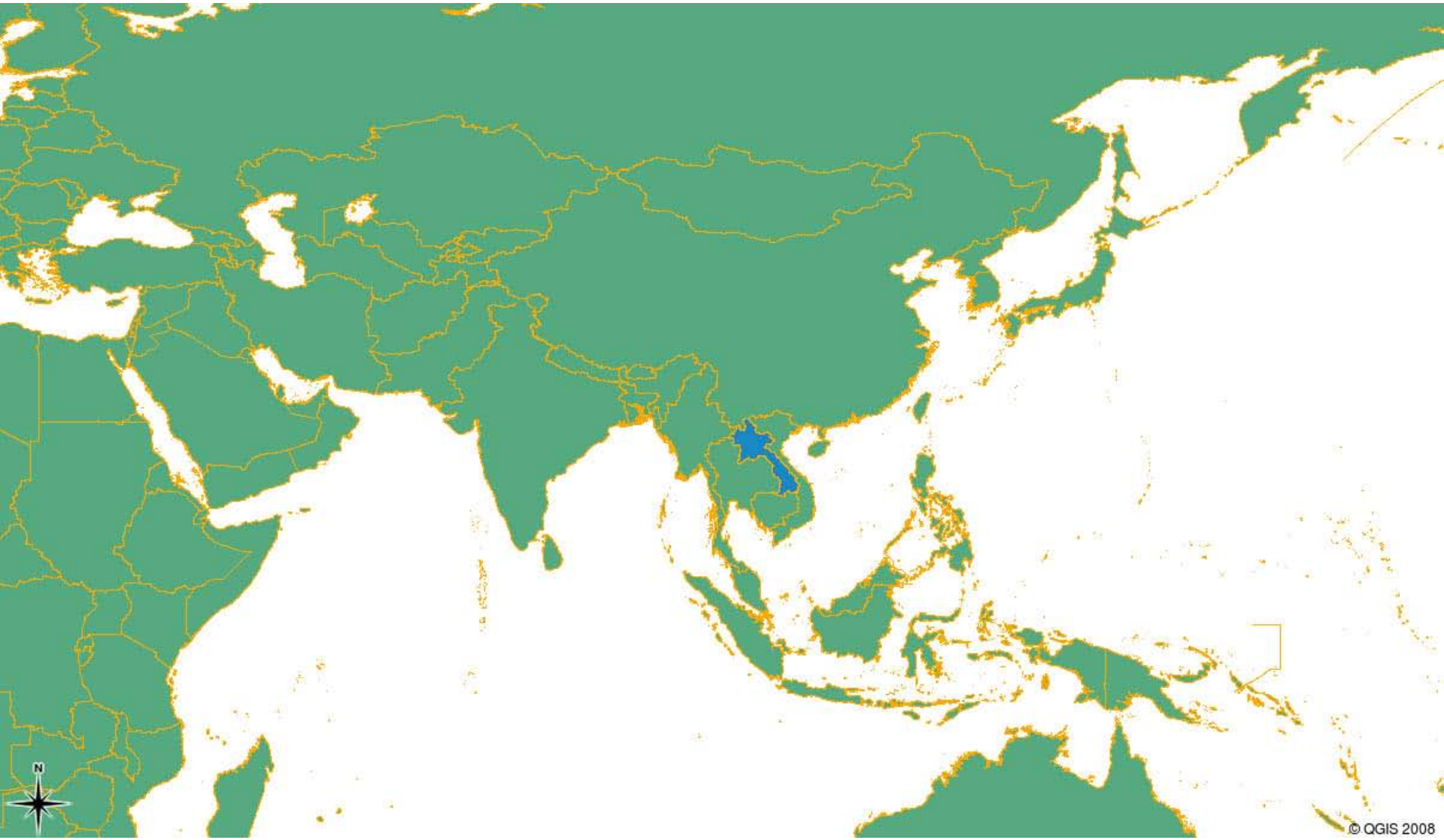
Alev is writing something on MuSIASEM and quality check on statistics

SUMMA ?

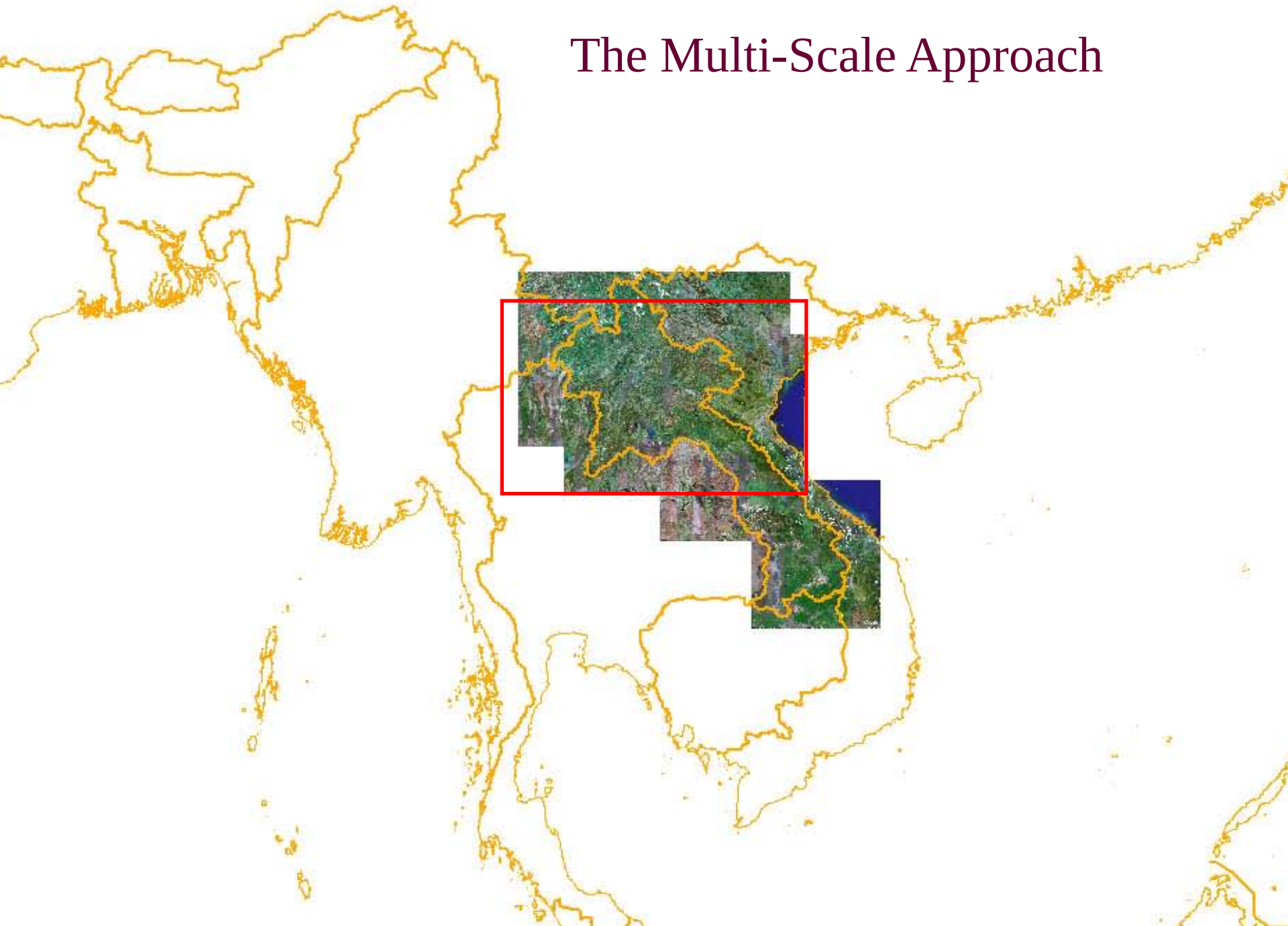
Examples of the hard work of Tarik

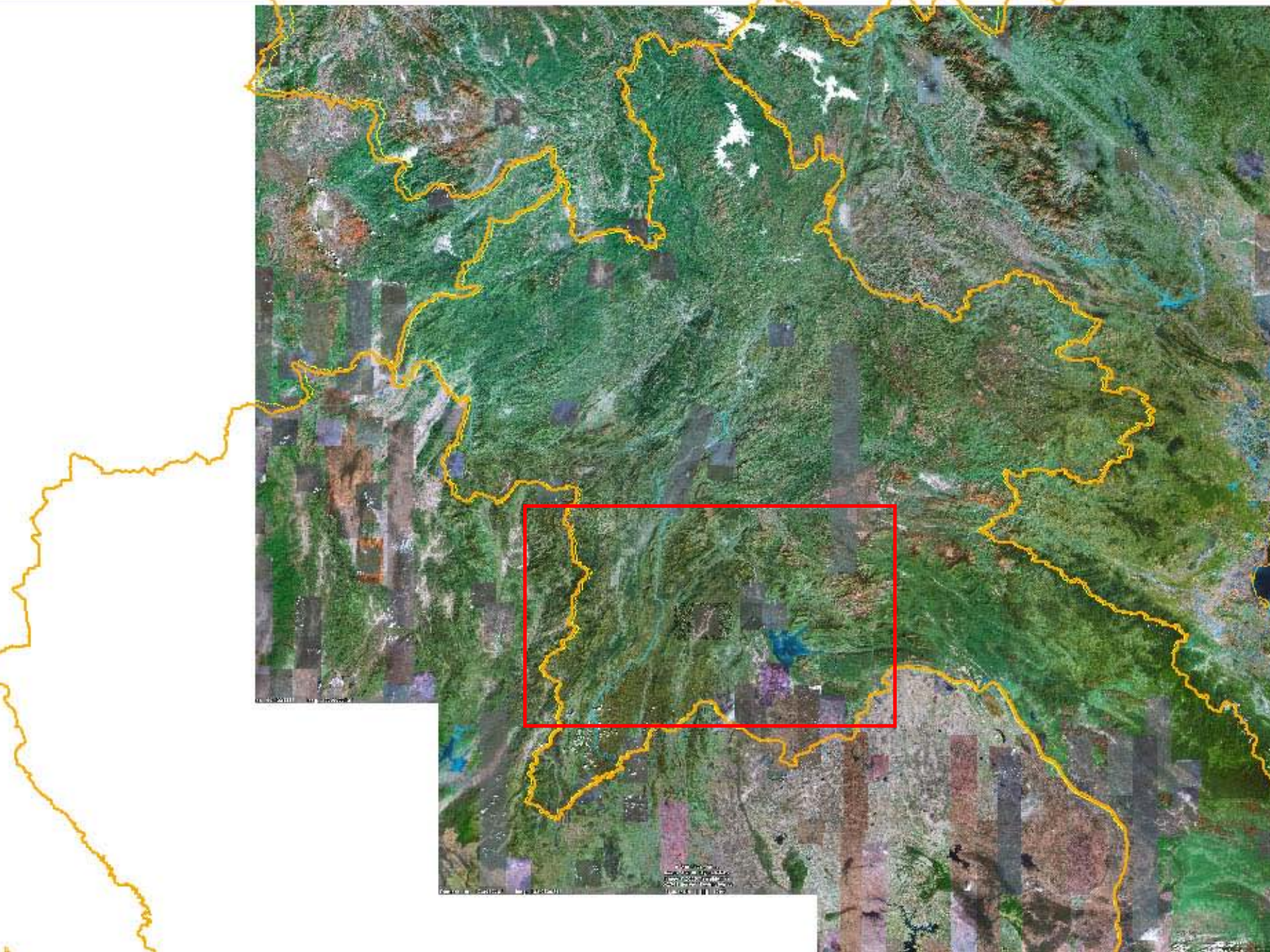
Studying a country without big cities . . .

RDP LAO



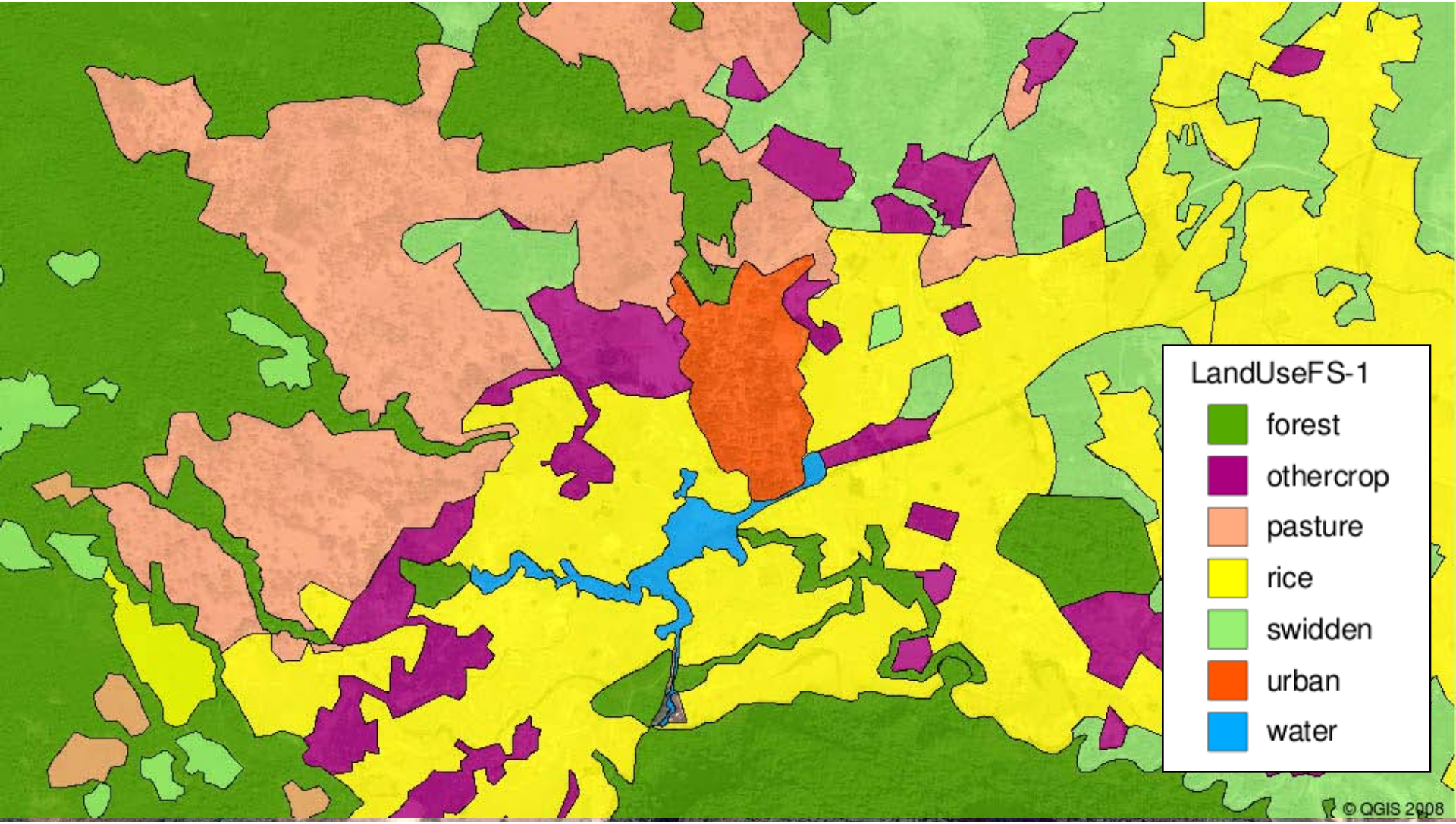
The Multi-Scale Approach



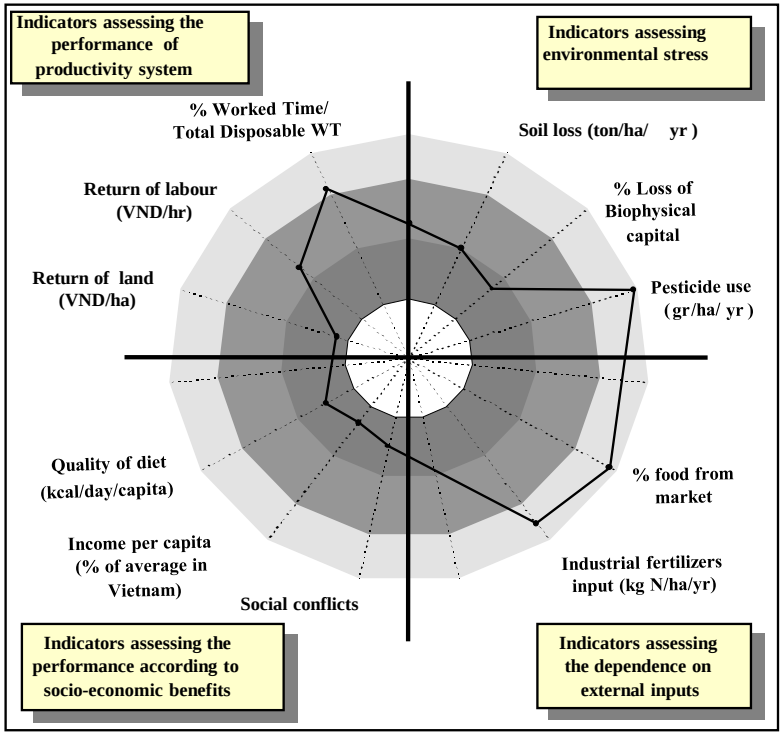


Farming System Type #1 - Slash&Burn

Land use analysis (level x)

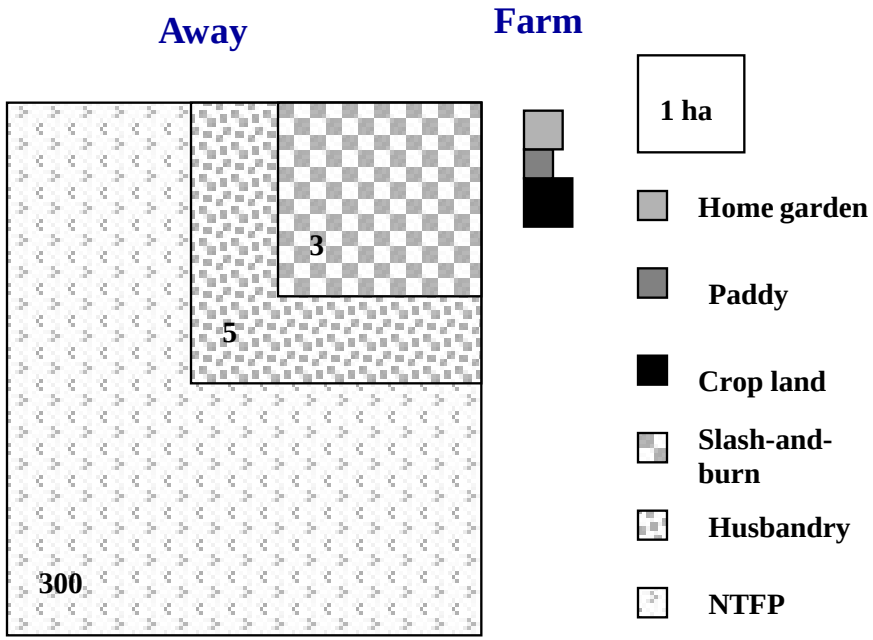


MOIR - HH Type A (Slash-and-Burn+Crop $_{mix}$)

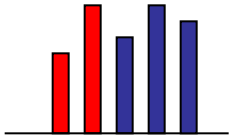


Household Type A

Land use pattern

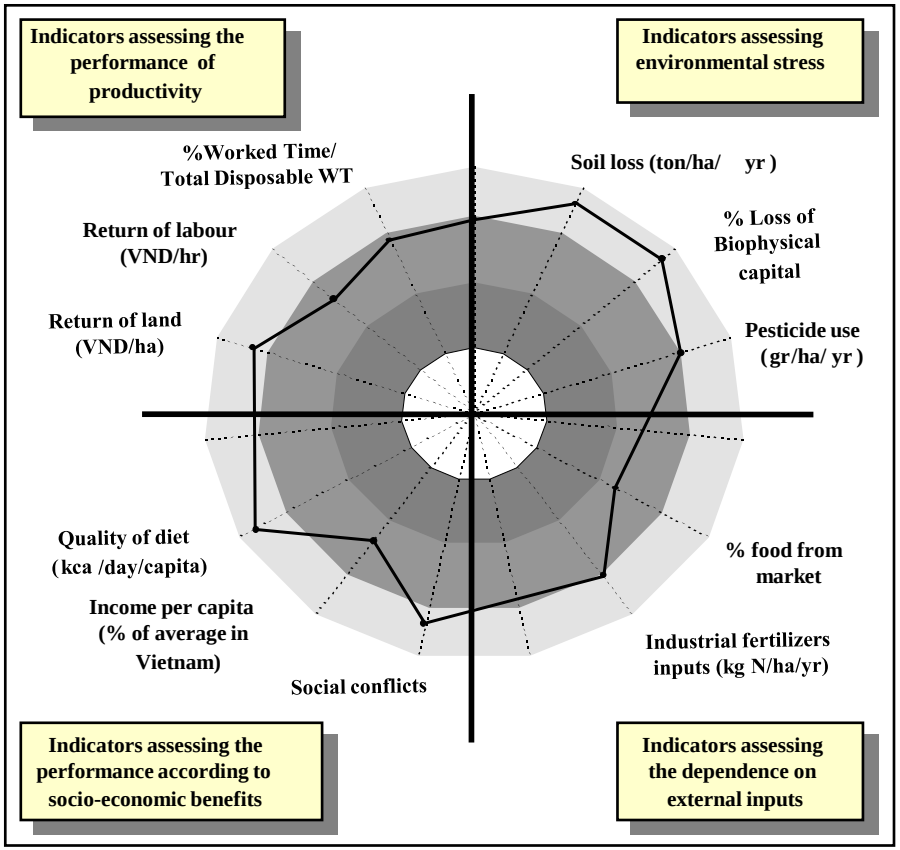


Identification of household farmer types



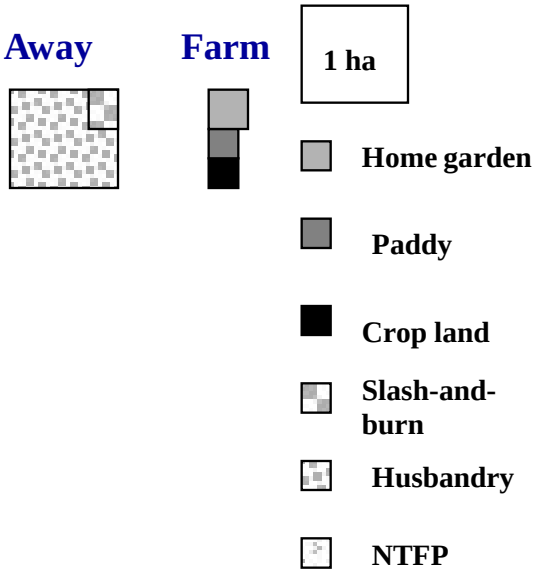
Profile of allocation of colonized land

MOIR - HH Type B (Rice + Cash Crops $_{mix}$)

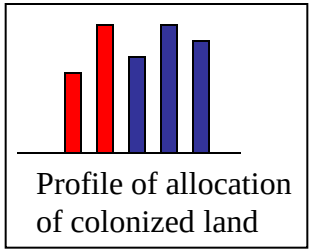


Household type B

Land use pattern

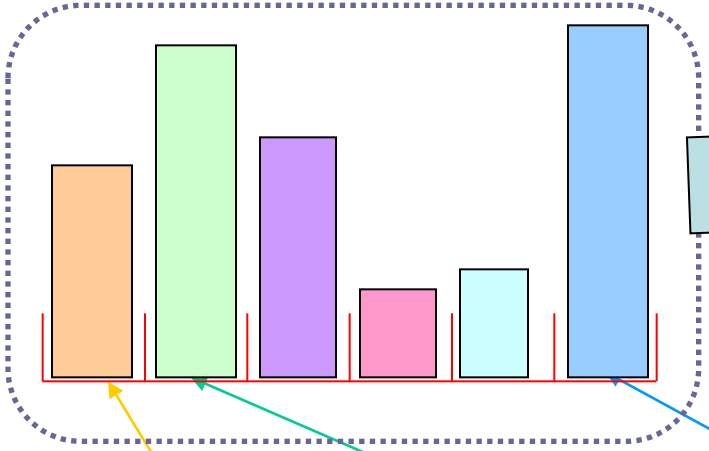


Identification of household farmer types

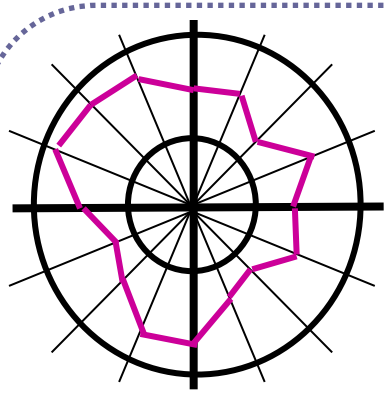


Scaling up → household types onto village types

The profile of distribution of the population of households over the set of types

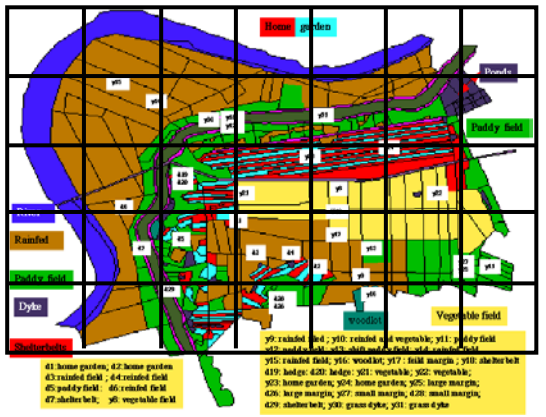


Profile of distribution of household types

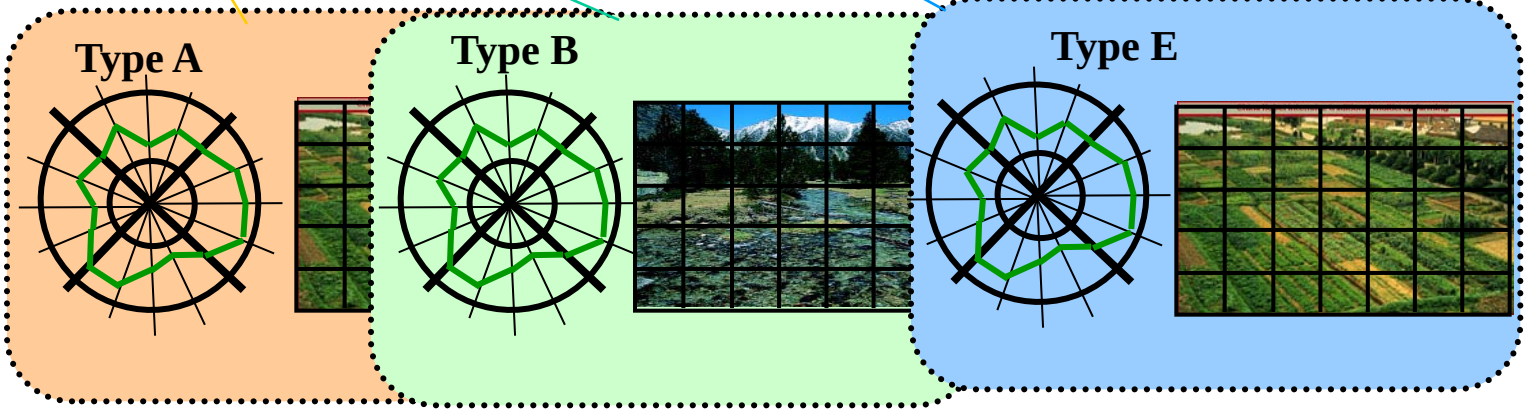


MOIR at the village level

Integrated Assessment at level n+1

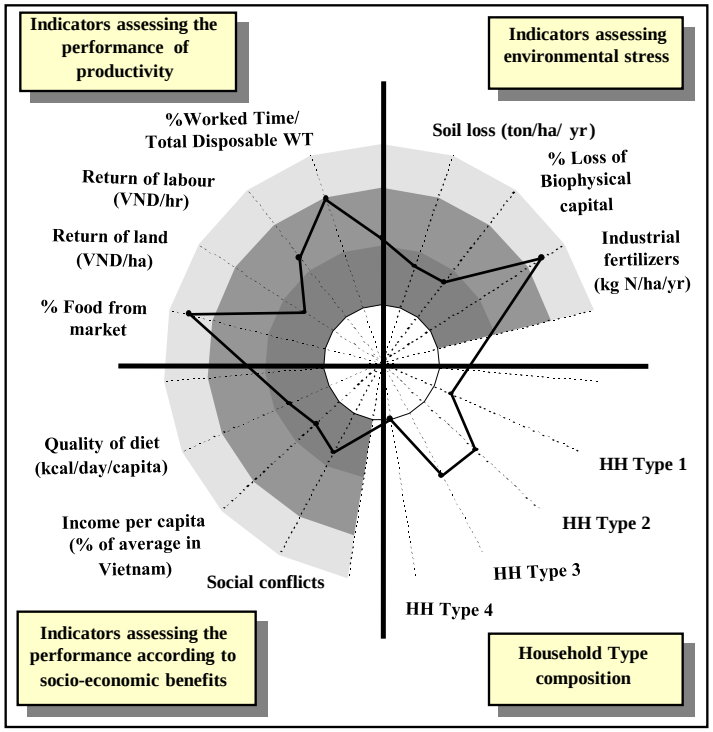


Land use map - village

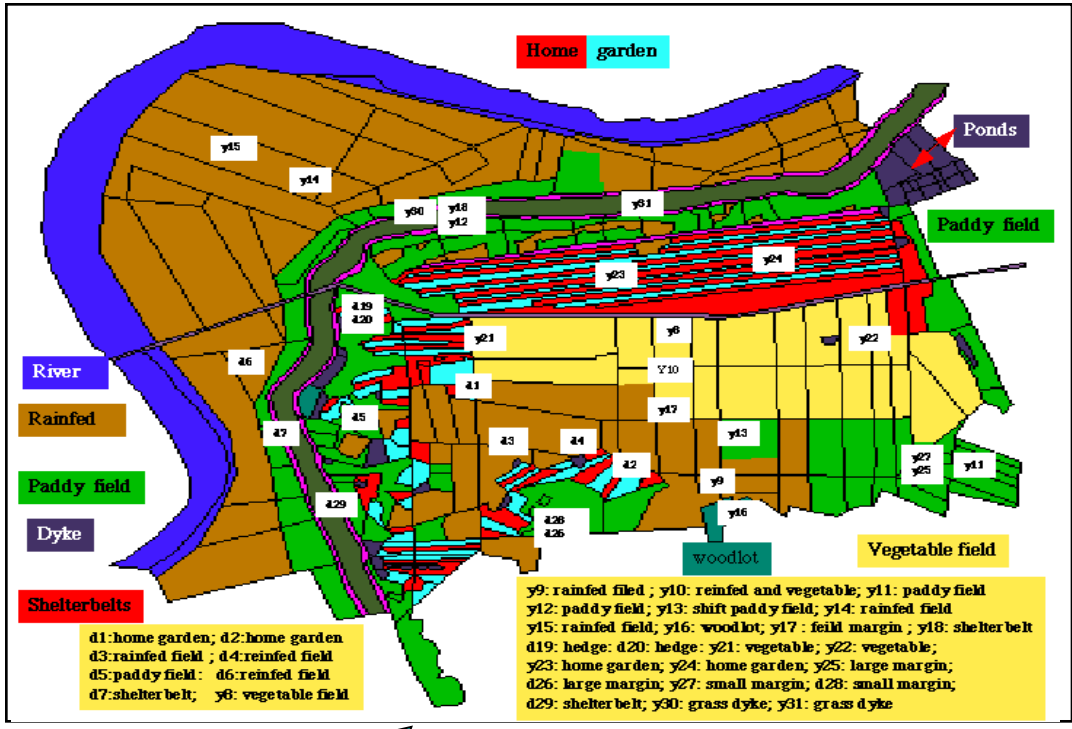


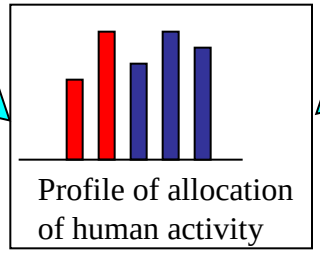
Socioeconomic performance ⟷ Land Uses map

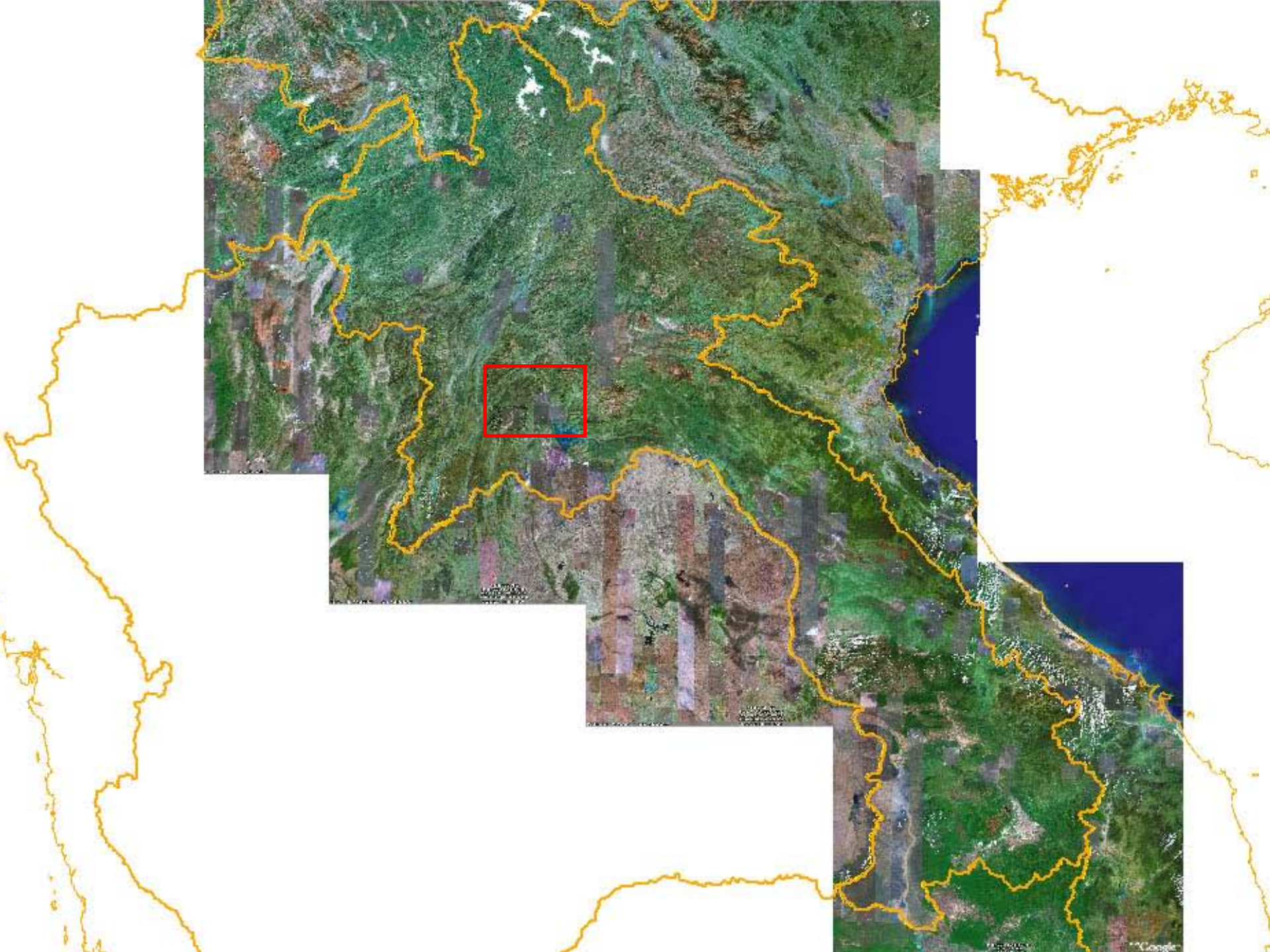
MOIR – Village Type #1

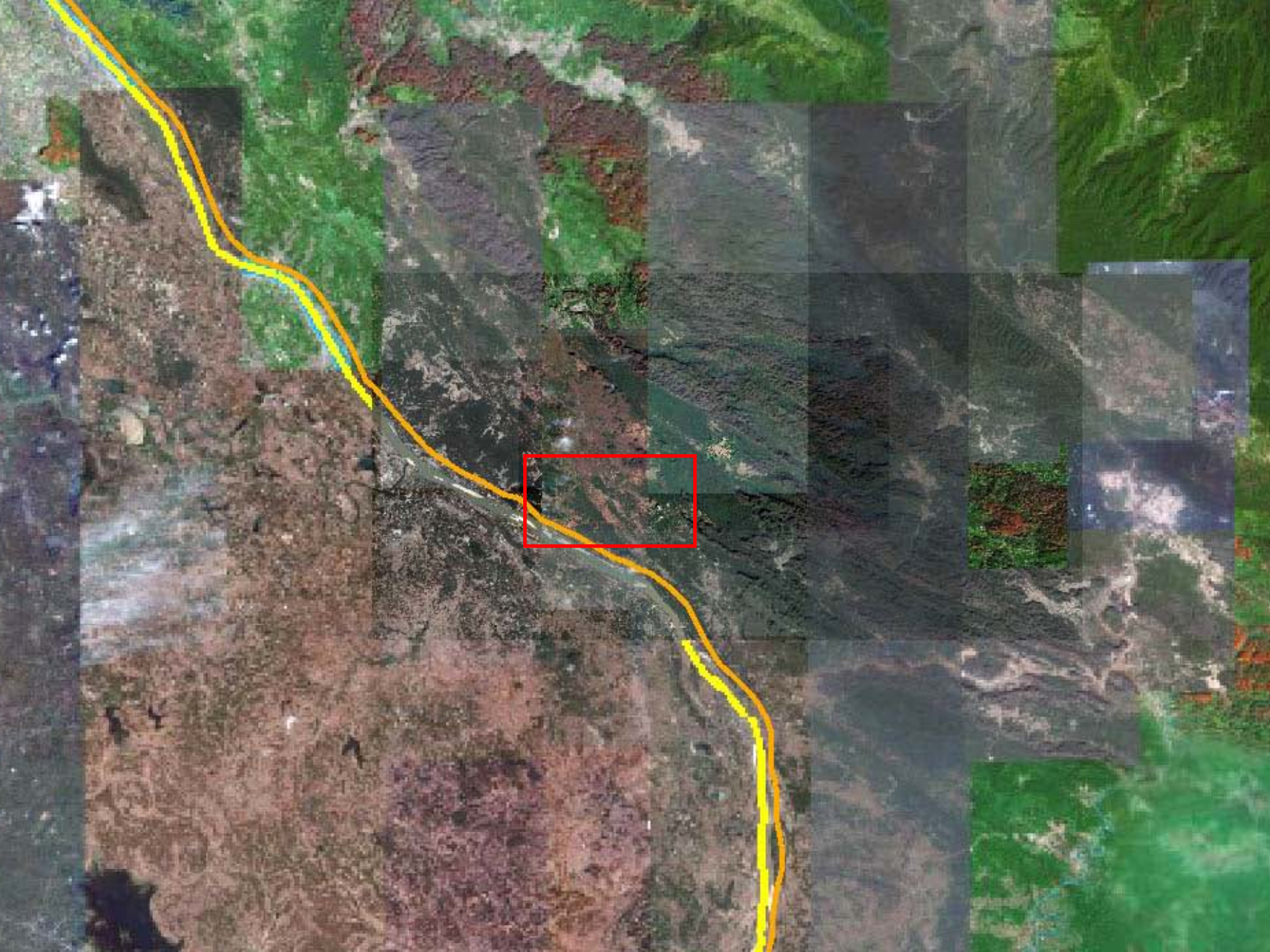


Land Uses Map Village

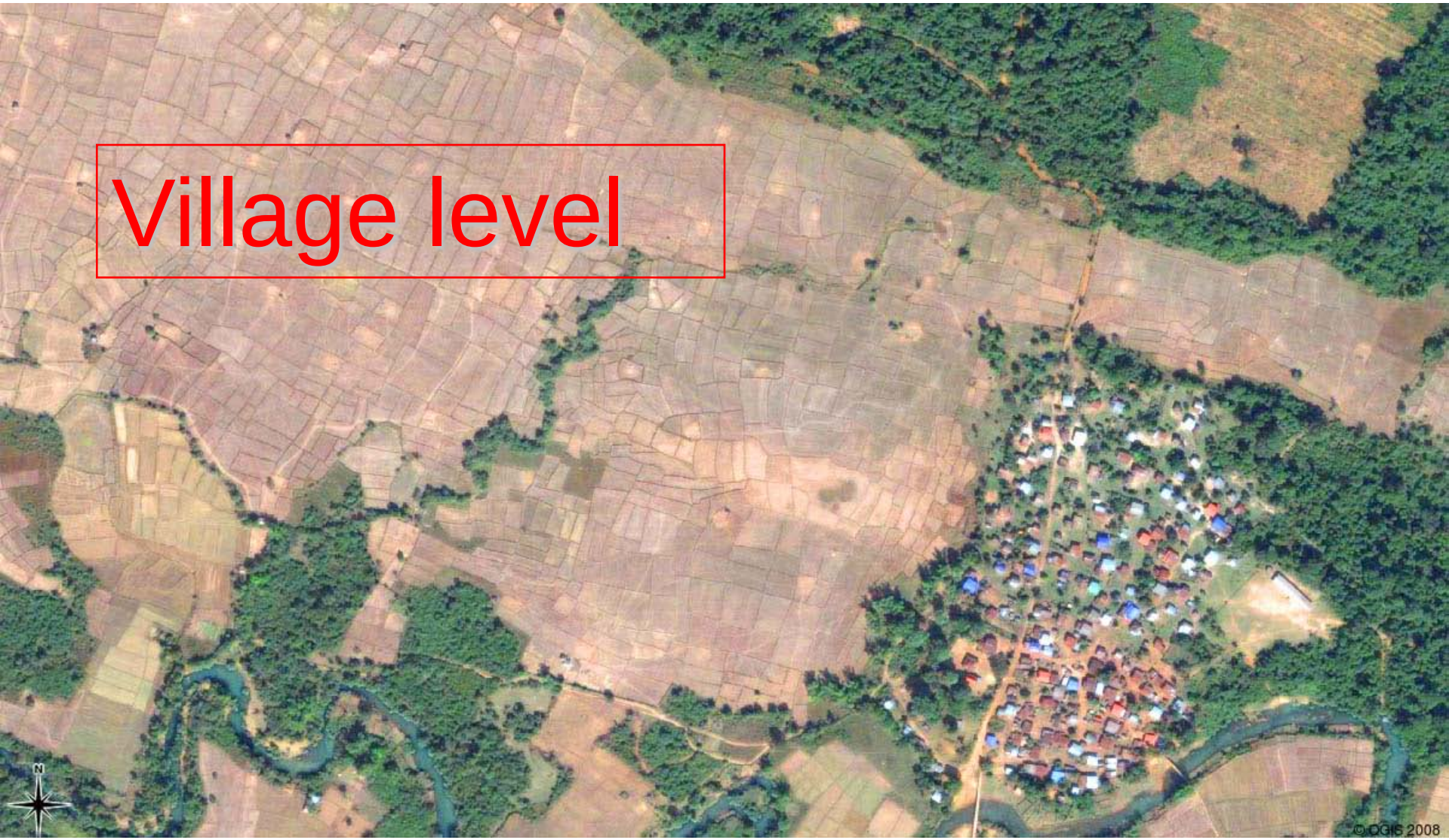








Farming System Type #2 Extensive rice cultivation

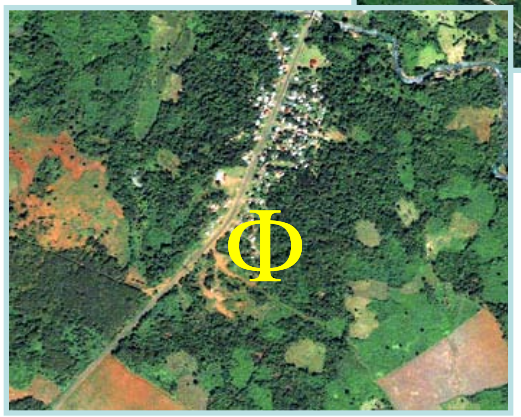


Farming System Type #3 – Cash Crops

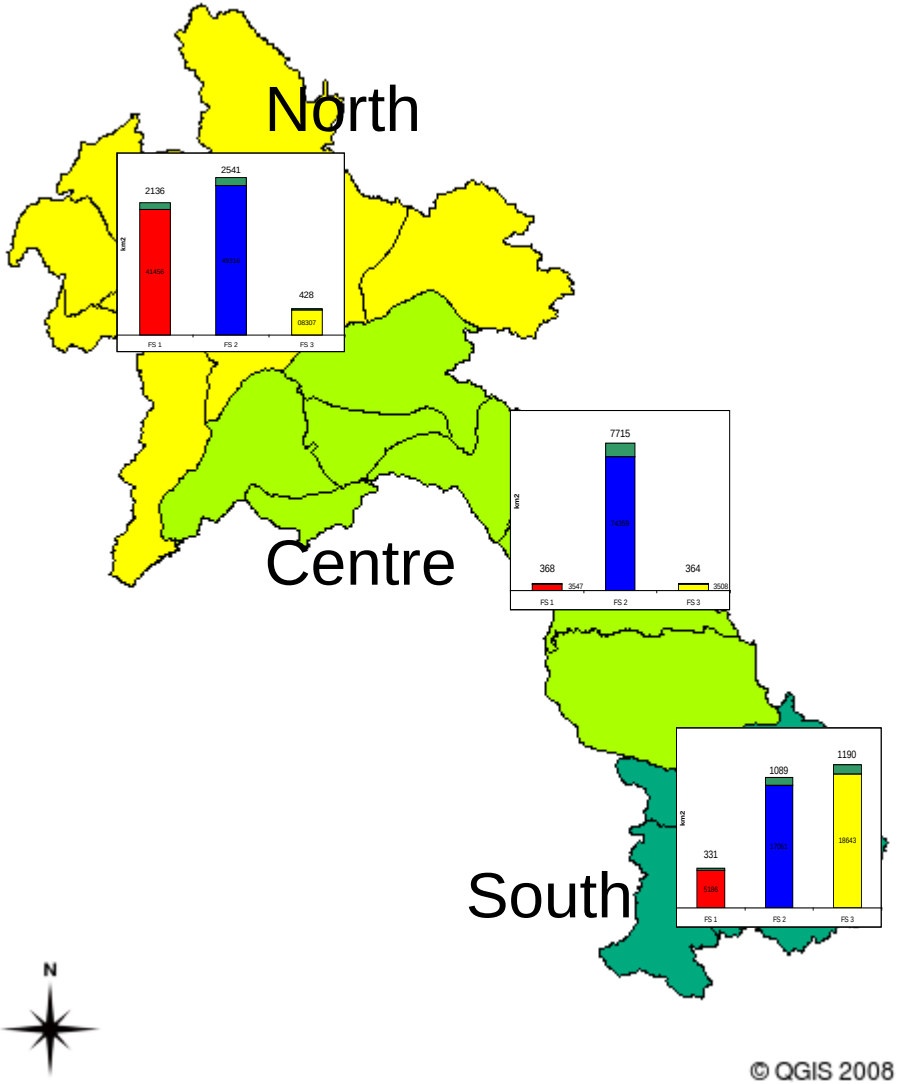
Moving to level x+1

Village
Type #1
Slash & Burn

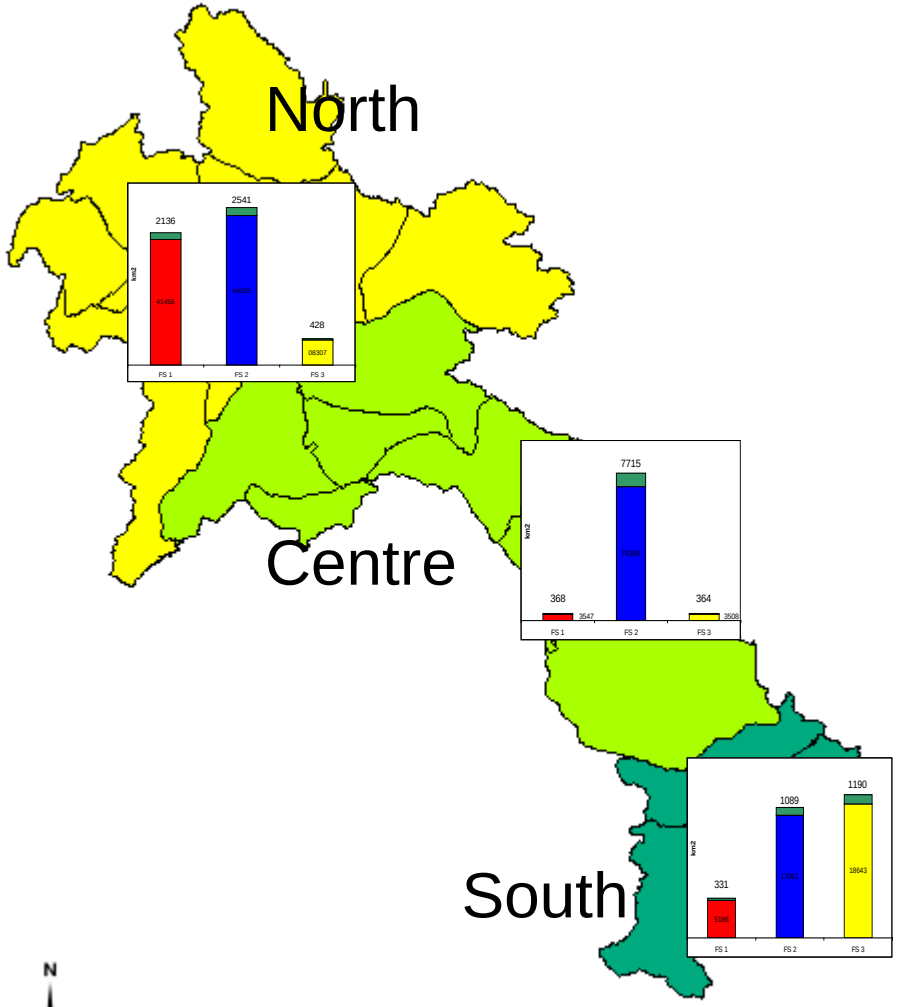
Village
Type #2
Extensive Rice

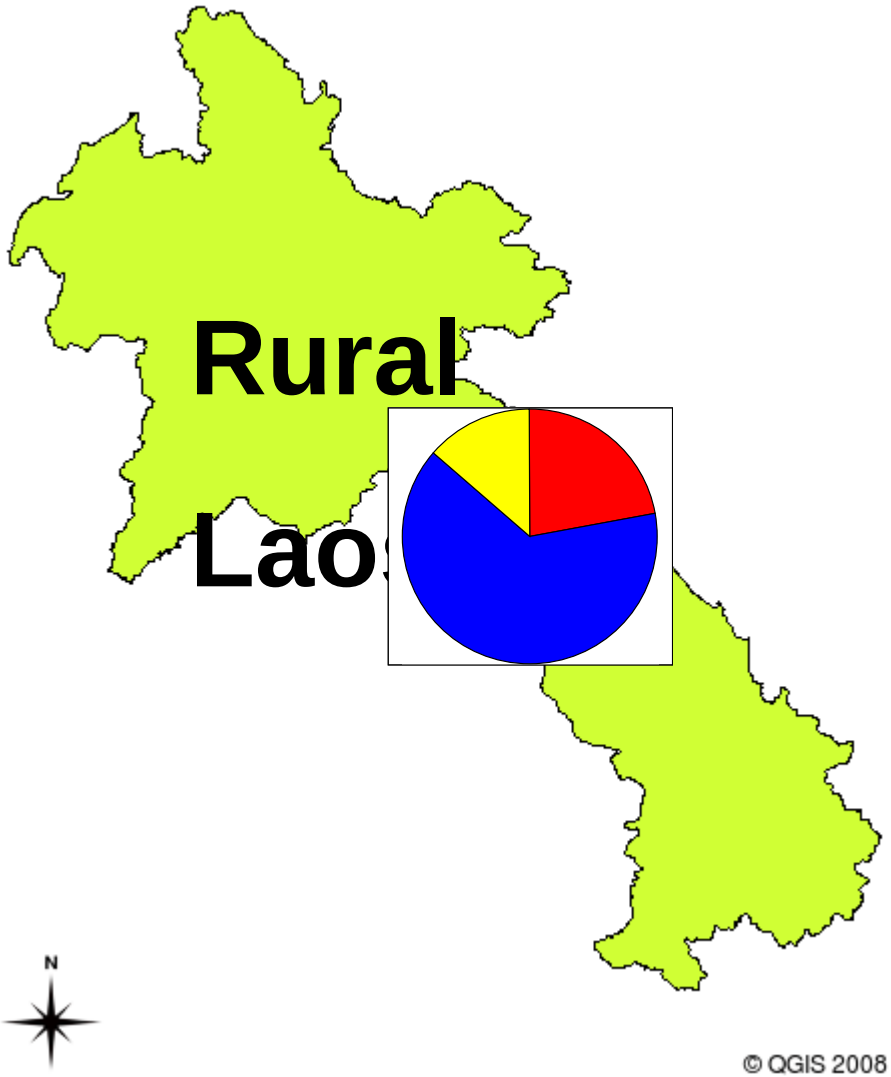


Village
Type #3
Cash Crops

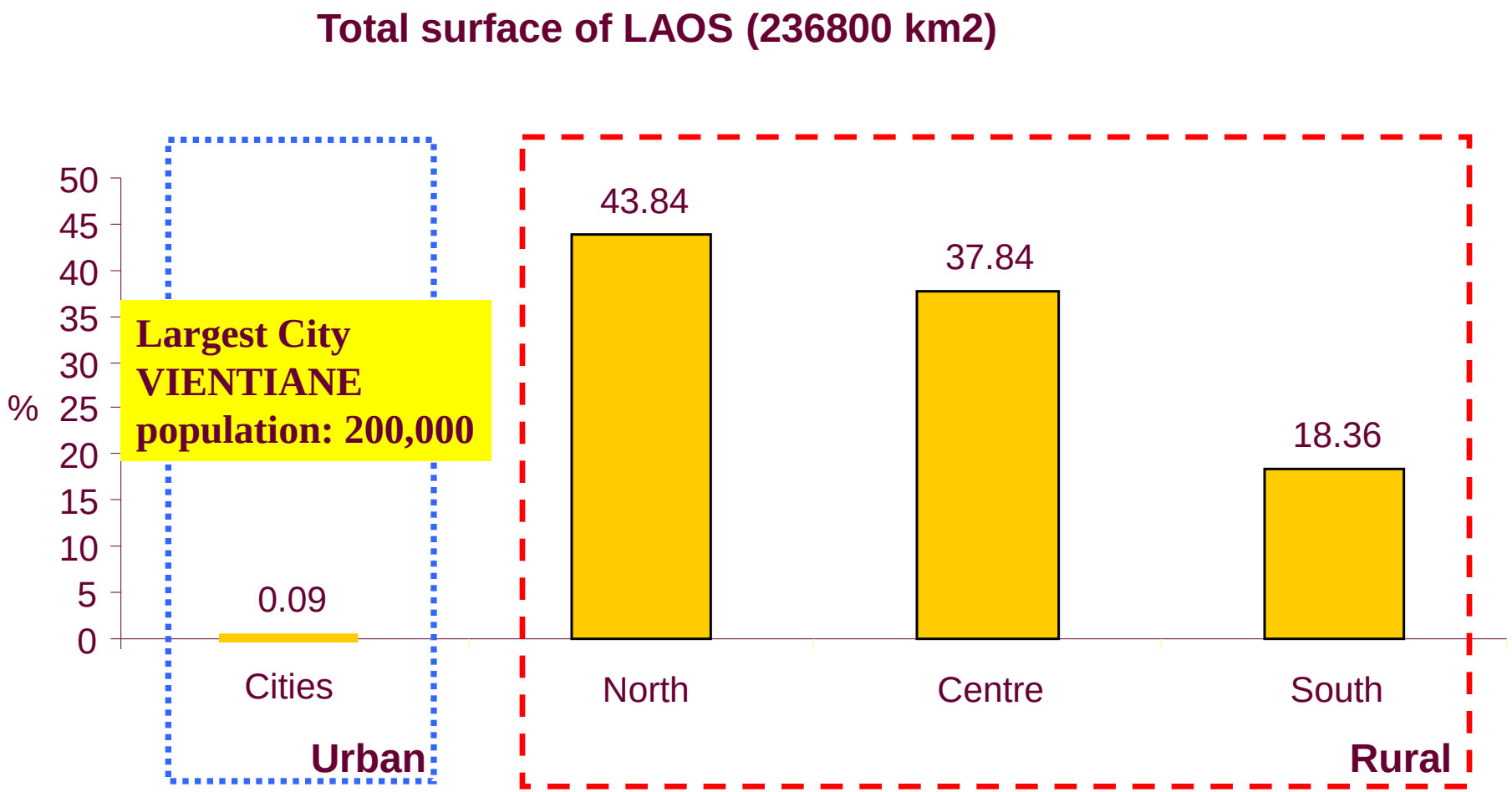


Moving to level x+2

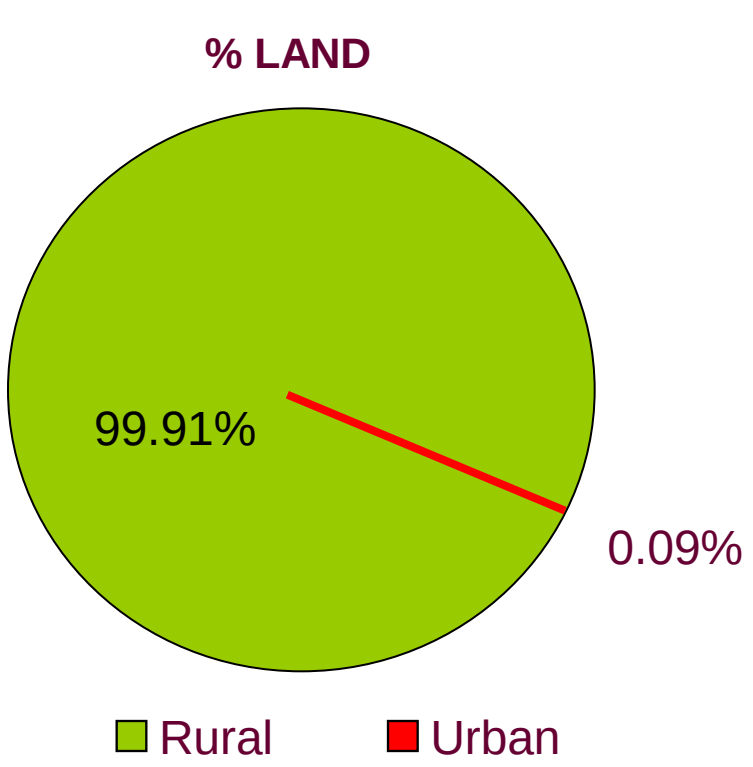


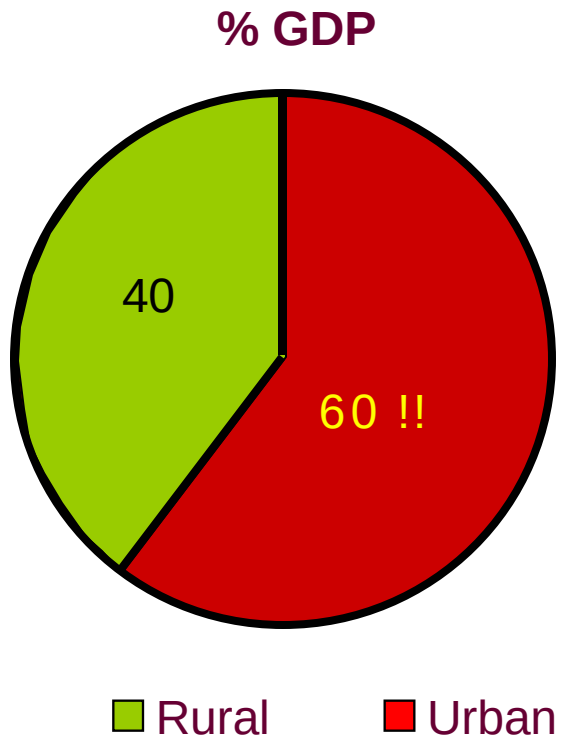


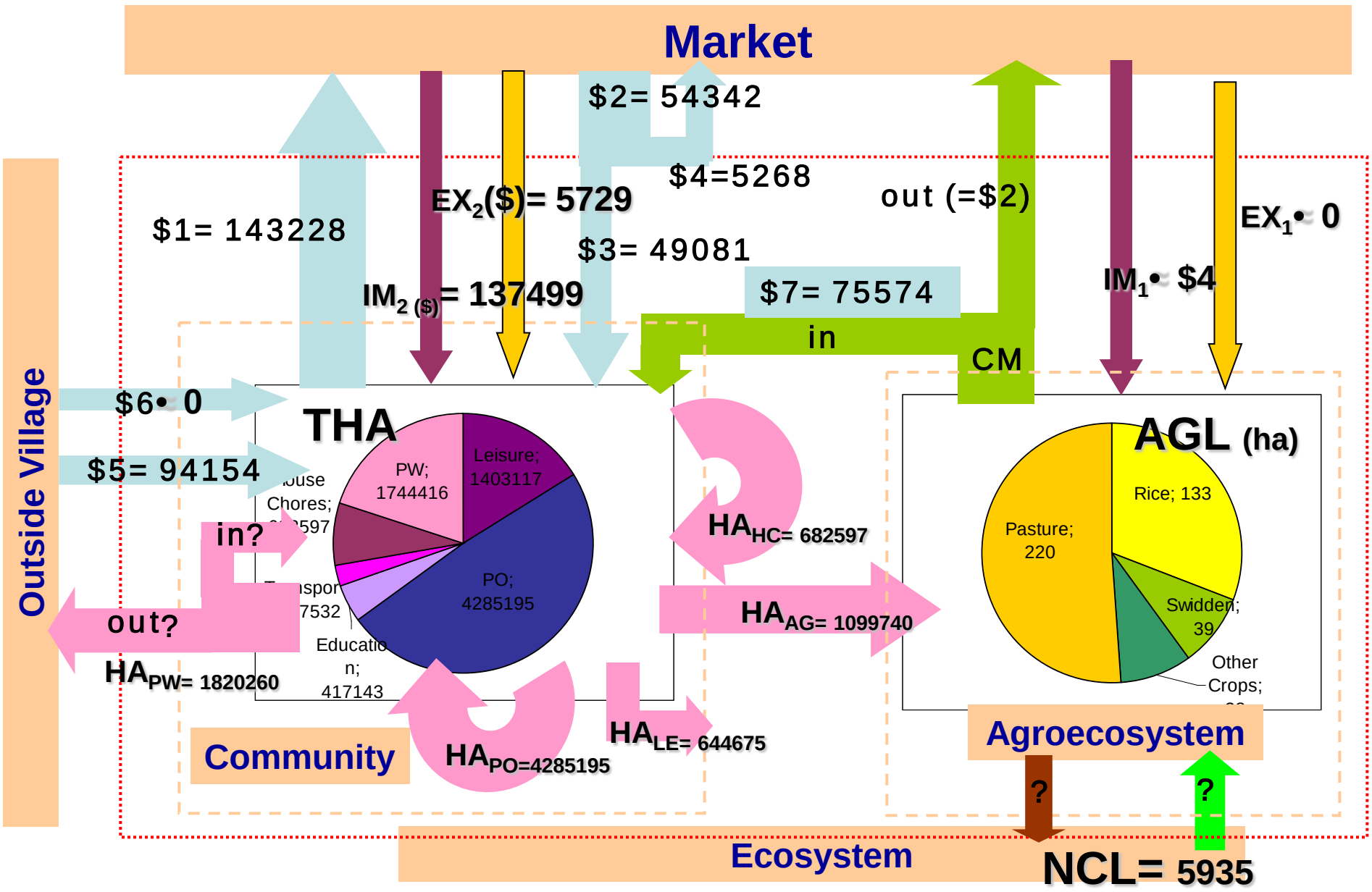
Level x+2 → LAOS



Level x+2 → LAOS



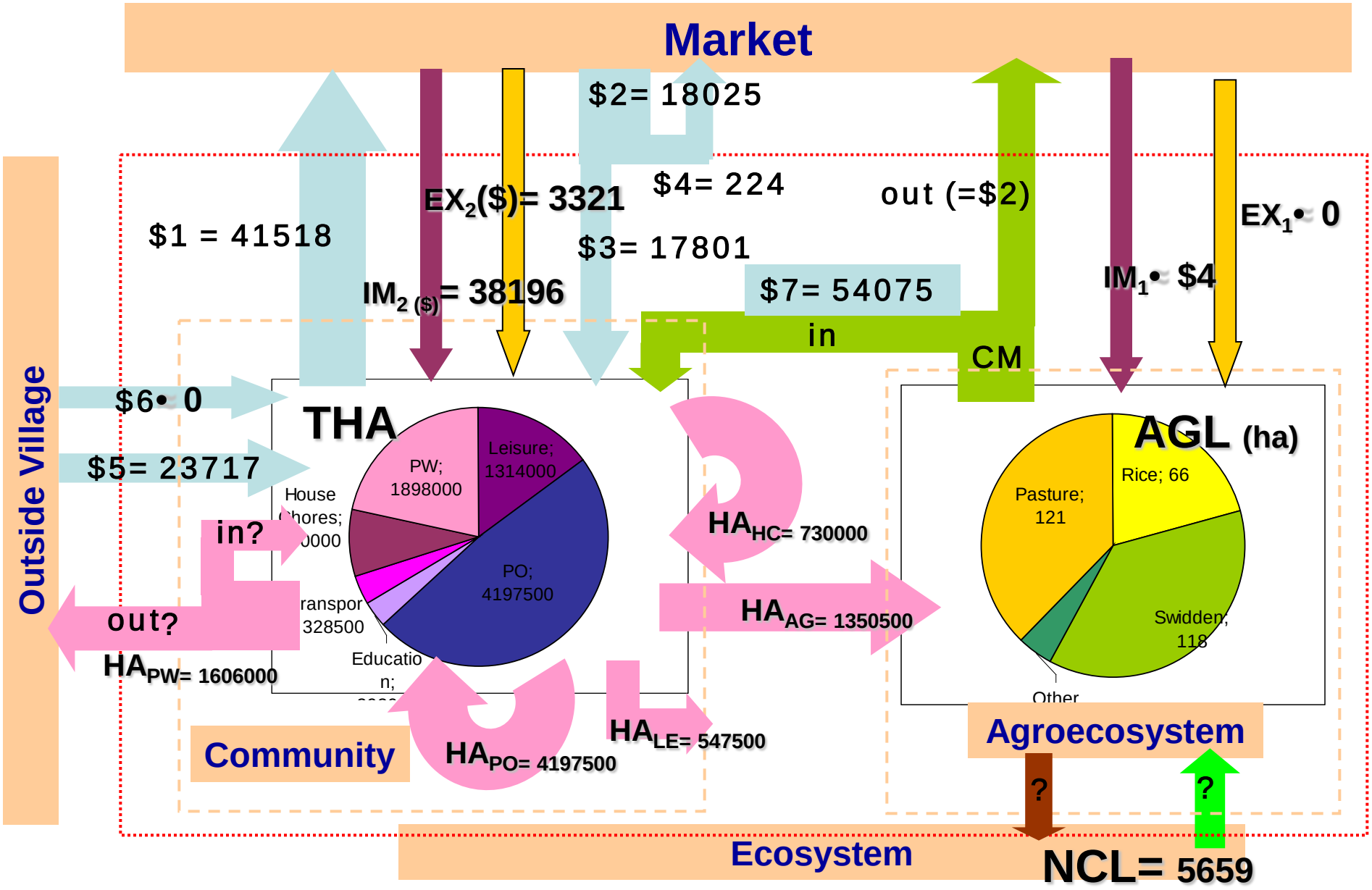



Level x+1
RURAL LAOS
Size FS 1 = 1,000 people
Size FS 1 = 433 ha (COL)
Market
$2= 54342
$4=5268
EX2($)= 5729
out (=$2)
EX1• 0
$1= 143228
$3= 49081
IM2 ($)= 137499
$7= 75574
IM1• $4
in
CM
Outside Village
$6• 0
$5= 94154
THA
PW; 1744416
Leisure; 1403117
PO; 4285195
Education; 417143
in?
out?
HAPW= 1820260
HAHC= 682597
HAAG= 1099740
HALE= 644675
HAPO=4285195
AGL (ha)
Rice; 133
Pasture; 220
Swidden; 39
Other Crops;
Community
Agroecosystem
Ecosystem
?
?
NCL= 5935

Level x

Farming System 1: (Slash & Burn)

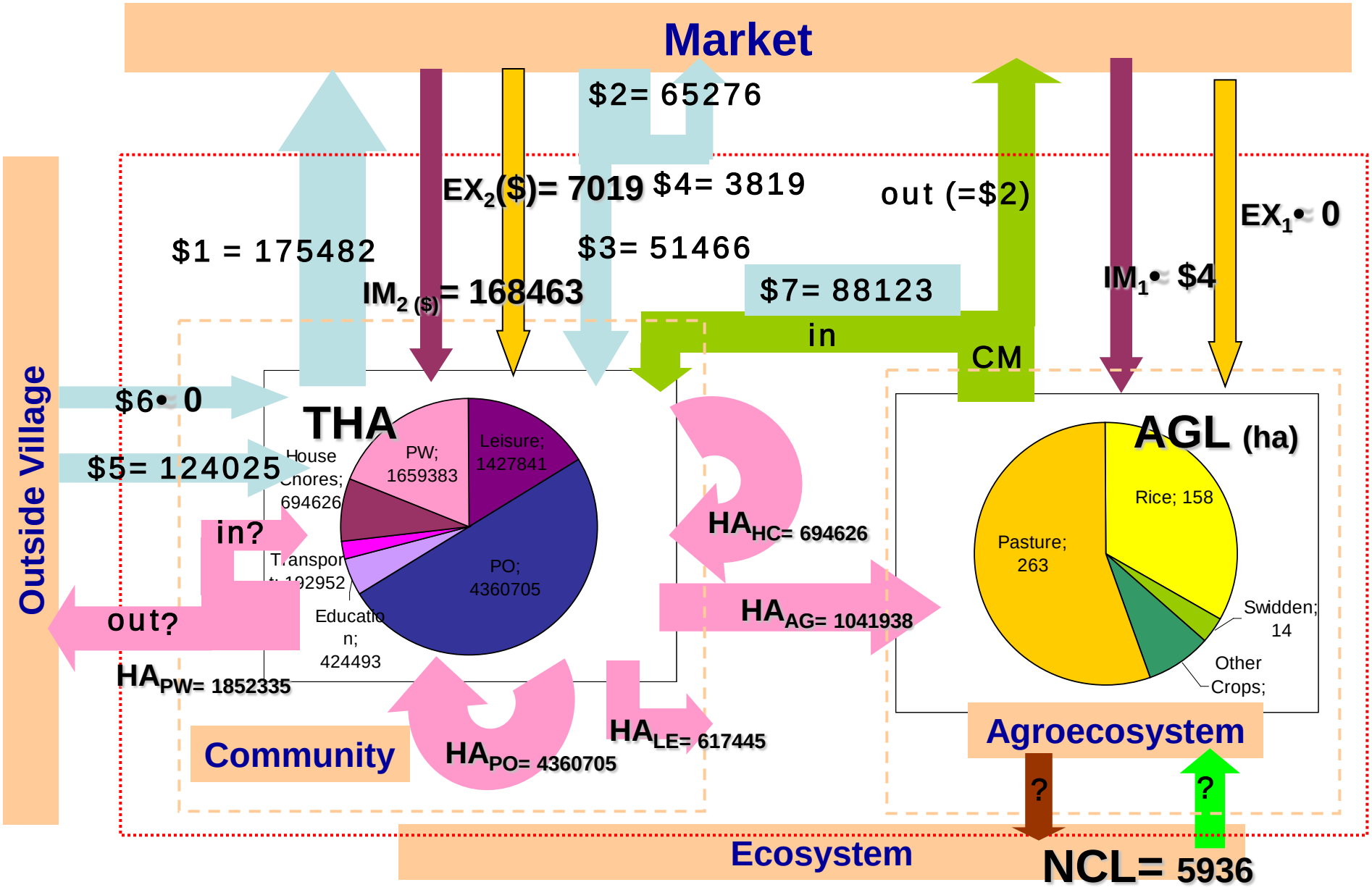
Size FS 1 = 1,000 people
Size FS 1 = 320 ha (COL)



Level x

Farming System 2: (Lowland Paddy Rice)

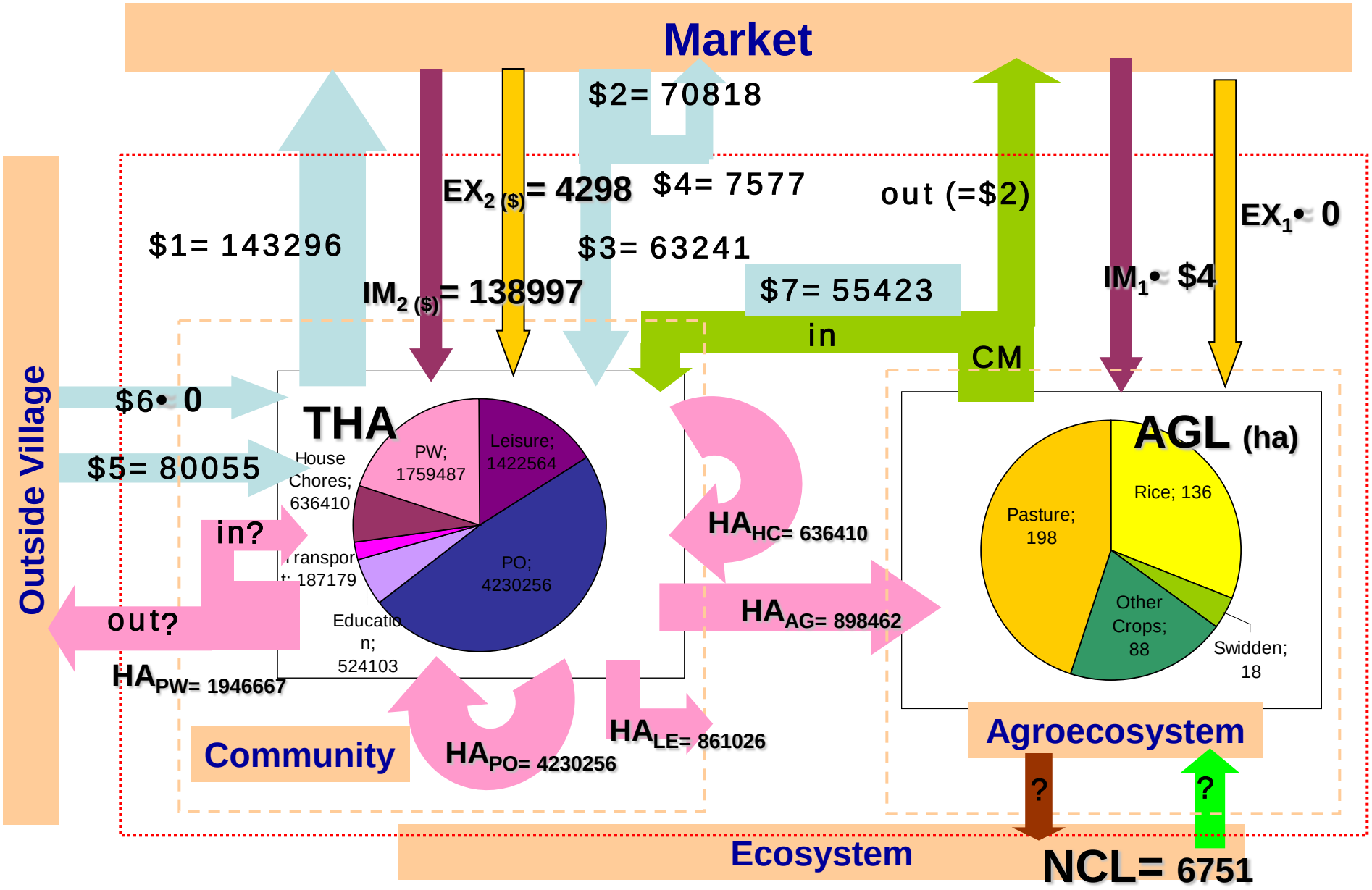
Size FS 1 = 1,000 people
Size FS 1 = 479 ha (COL)



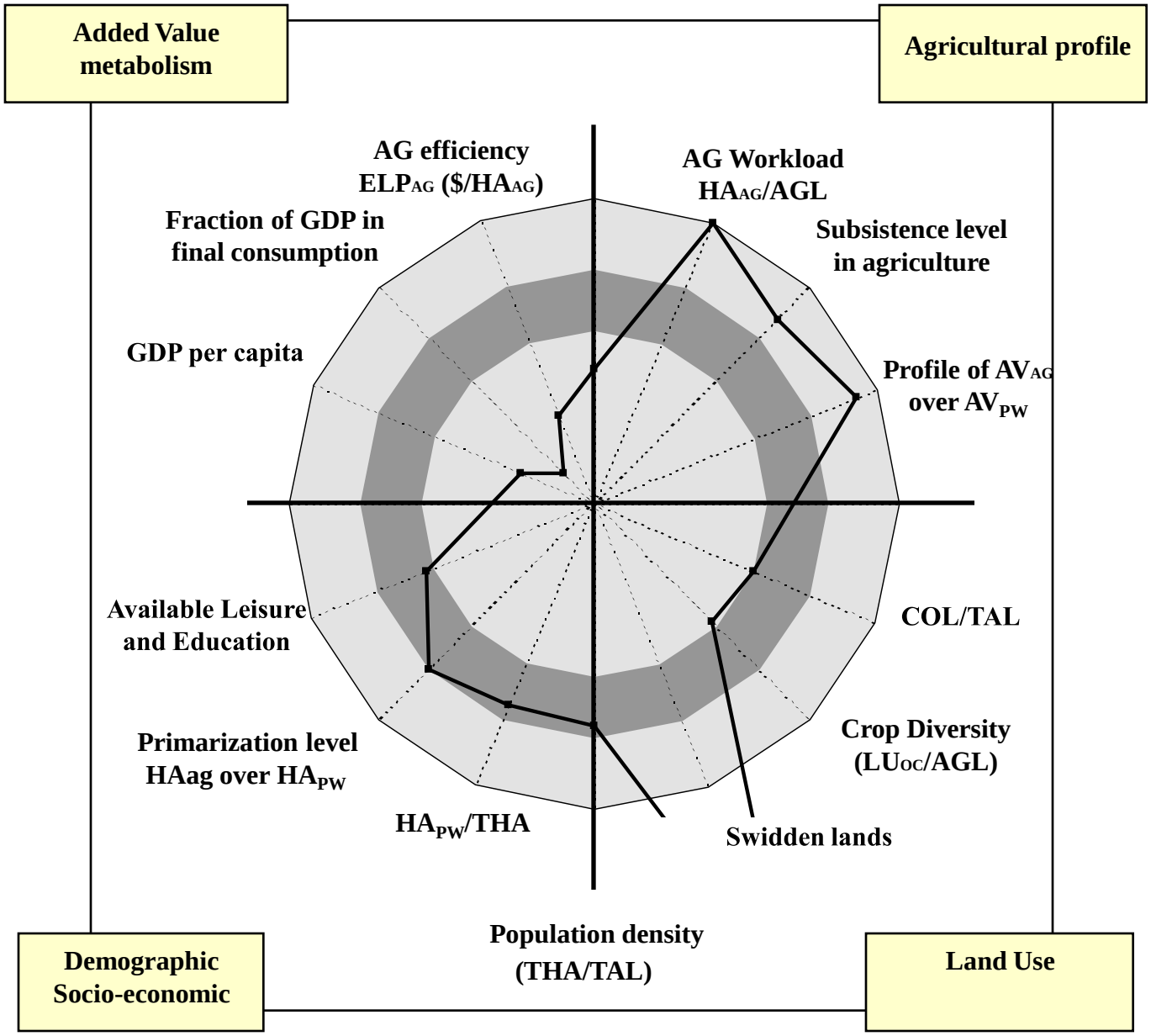
Level x

Farming System 3: (Commercial crops)

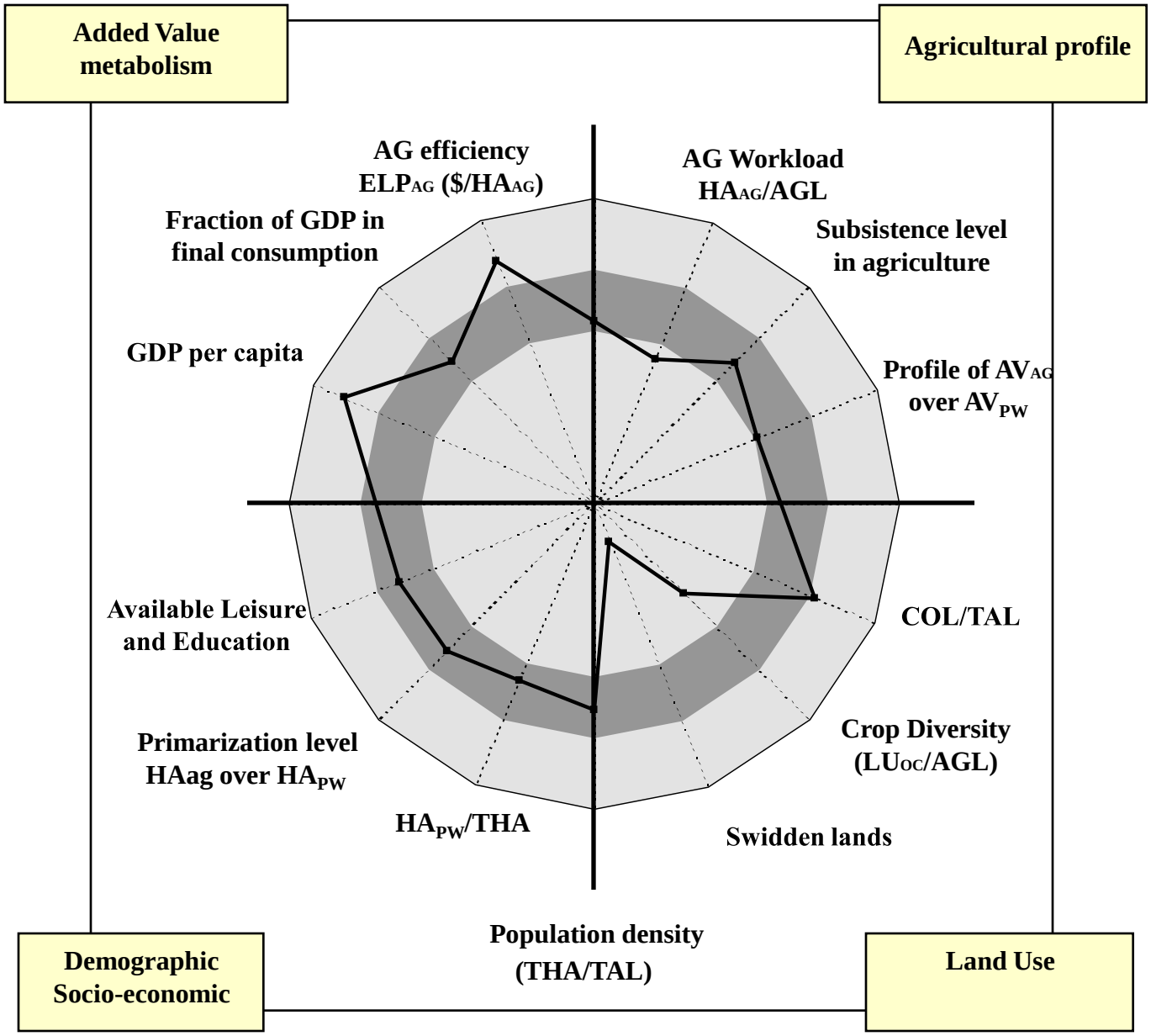
Size FS 1 = 1,000 people
Size FS 1 = 440 ha (COL)



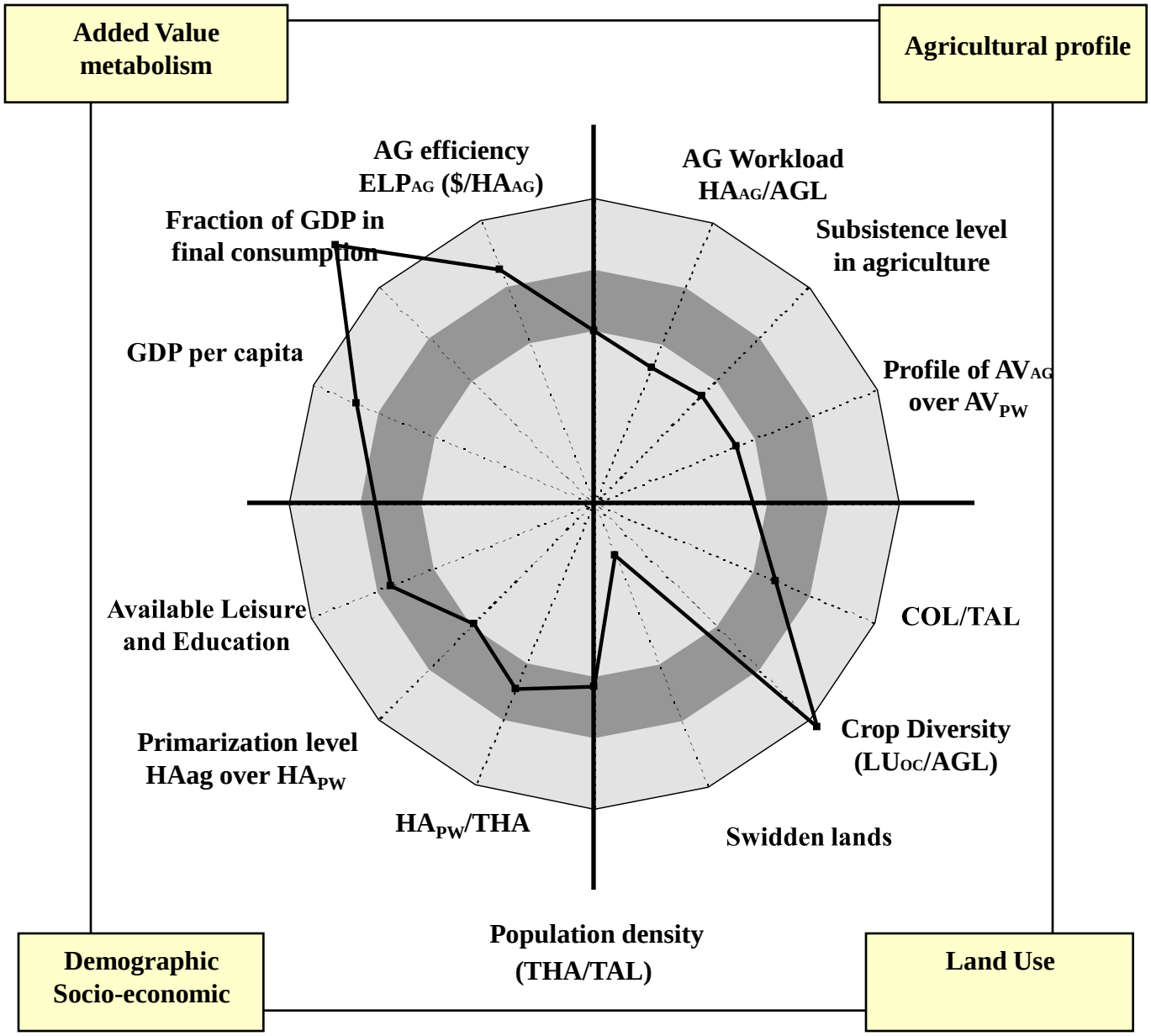
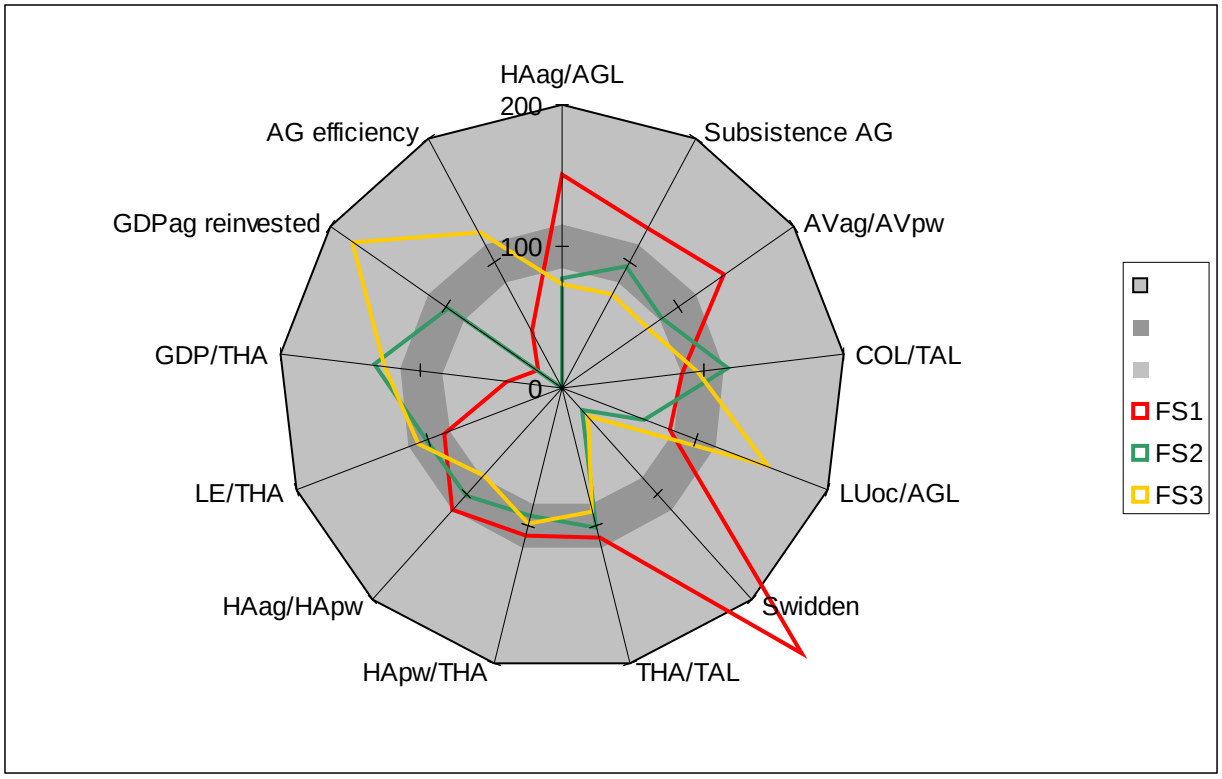
Farming System 1



Farming System 2



Farming System 3



Comparison of the 3 Farming systems