VOLANTE

VISIONS OF LAND USE TRANSITIONS IN EUROPE

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Description of the linked modelling system of sector models and multi-sector assessments

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COOPERATION

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Chapter 1: Introduction

The updated top-down modelling chain in WP7, the data flow between the models, as well as a detailed description of the scenario implementation for the four marker scenarios has been described in deliverable D7.1. This deliverable D7.2 should be seen and read in combination with D7.1, in order to avoid repetition of information already provided there.

Based on the detailed scenario description and implementation, D7.1 provides an overview of results from the global models ReMIND/MAgPIE, LEITAP/MAGNET, and EFI-GTM. These results have been fed into the European agricultural sector model CAPRI, the European forest growth model EFISCEN, and the European land-use allocation model CLUE. Additional inputs from JRC on EU-country-based changes in urban and built-up areas have also been used. Detailed model descriptions have been provided in Deliverable D5.1.

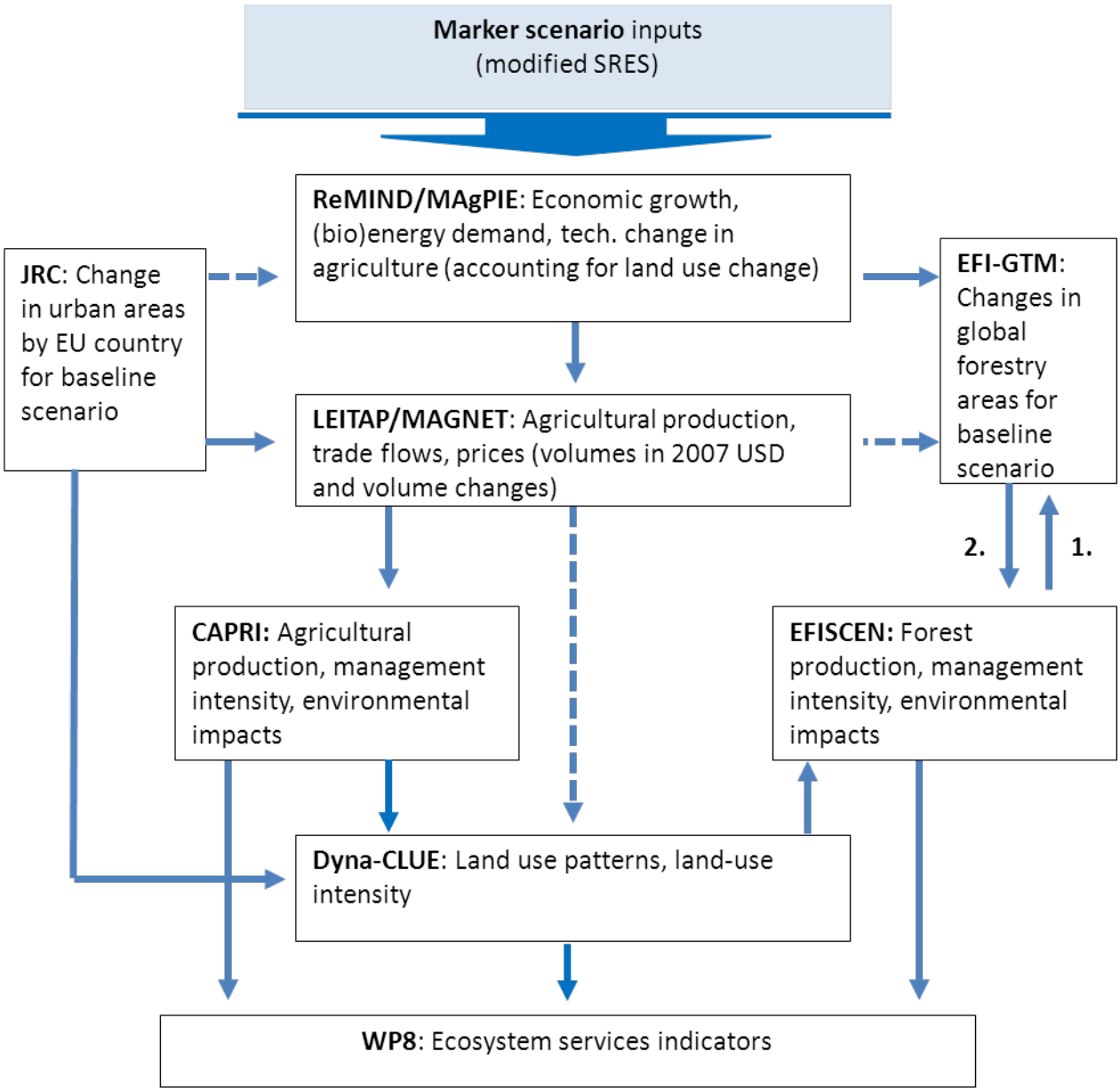
Compared to the originally planned data flow between the models, there has been a change regarding the link between the economic models and the model CLUE (see Fig. 1). For the current version of this deliverable, CLUE has taken inputs on agricultural land use from the LEITAP/MAGNET model, due to timing issues. At a later stage this will be changed. CLUE will then be linked to CAPRI outputs, as these are available at sub-national levels and are closer to the requirements of the ecosystem service assessments.

Regarding outputs from the forestry model EFISCEN for the four marker scenarios, there has been a delay, due to parental leave of a key researcher at EFI. Updated output from EFISCEN is now scheduled to be ready by the end of November 2012. In this deliverable, selected outputs from EFISCEN are taken from previous model runs.

The CLUE model is positioned at the end of the top-down modelling chain. Since necessary results from the other models became only available by mid of October, and the CLUE model requires significant run times, so far only results for the B1 scenario are available from CLUE. The other three marker scenarios are to be finished by mid of December 2012.

The results in this deliverable will be mainly provided as graphs. Detailed figures on specific model outputs are available at the WP7 FTP site, as described in Deliverable D5.1.

Figure 1: Data flow and top-down modeling chain
(Status: October 2012)



Chapter 2: Selected results from the linked modelling system

Based on the marker scenario-specific changes in GDP, population, and economy-wide effects from LEITAP/MAGNET, the CAPRI model provides detailed changes in agricultural supply for the EU-27, Norway, Western Balcans, and Turkey. It covers about 280 regions at the NUTS 2 level. Key outputs of the model for the EU are regional land use, agricultural income indicators as well as a number of environmental indicators.

From the results of CAPRI it becomes clear that land use change in the marker scenarios is mostly driven by assumptions with respect to CAP-related subsidies (i.e. abolishment of direct farm payments in scenarios A1 and B1). Hence, in Scenarios A1 and B1 agricultural area is significantly reduced (see Fig. 2 and Fig. 3). Pasture areas are more affected by changes in CAP subsidies than arable crop areas (see Fig. 4).

Changes in diets (i.e. less consumption of livestock products) in scenarios B1 and B2 affect the use of agricultural land, mainly through changes in animal feed demand. In the A1 and B1 scenarios, the average intensity of agricultural land use increases, as more extensive and less productive land is abandoned. This is especially the case in the EU-12. The increase in intensity in scenario B1 is dampened by changes in diets (and related decrease in livestock production). In A2 and B2, average intensity of agricultural land in EU15 decreases, as less productive land is taken into production again (see Fig. 5).

Figure 2: Agricultural area in 2020, compared to 2010

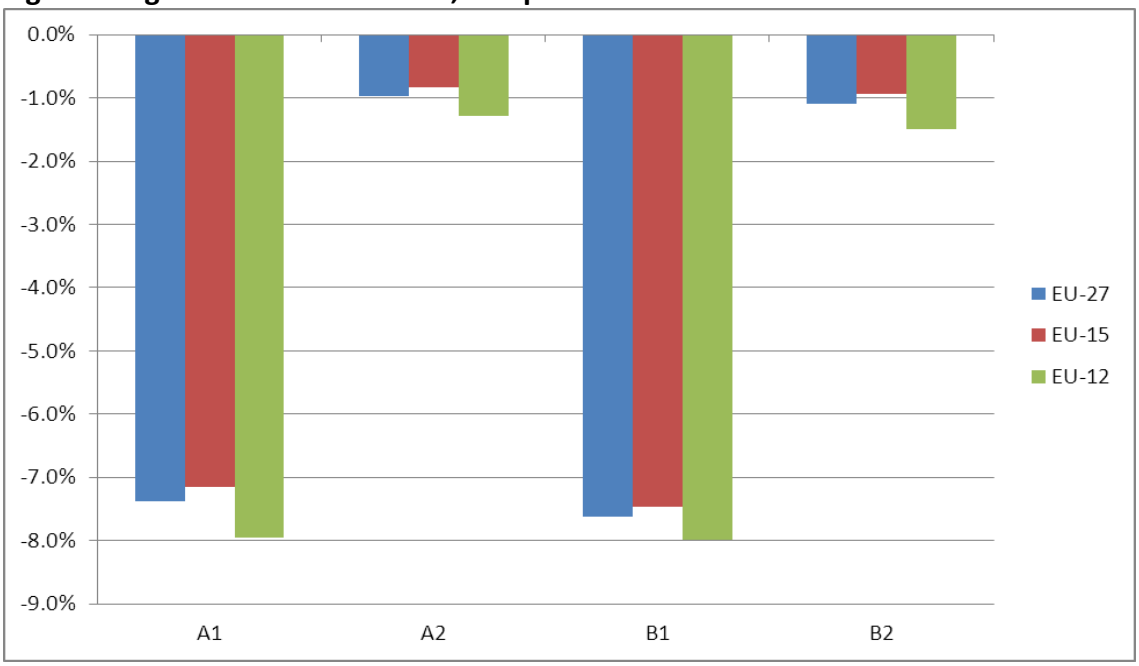


Figure 3: Percentage change in agricultural area in 2020: Scenario A2 compared to A1

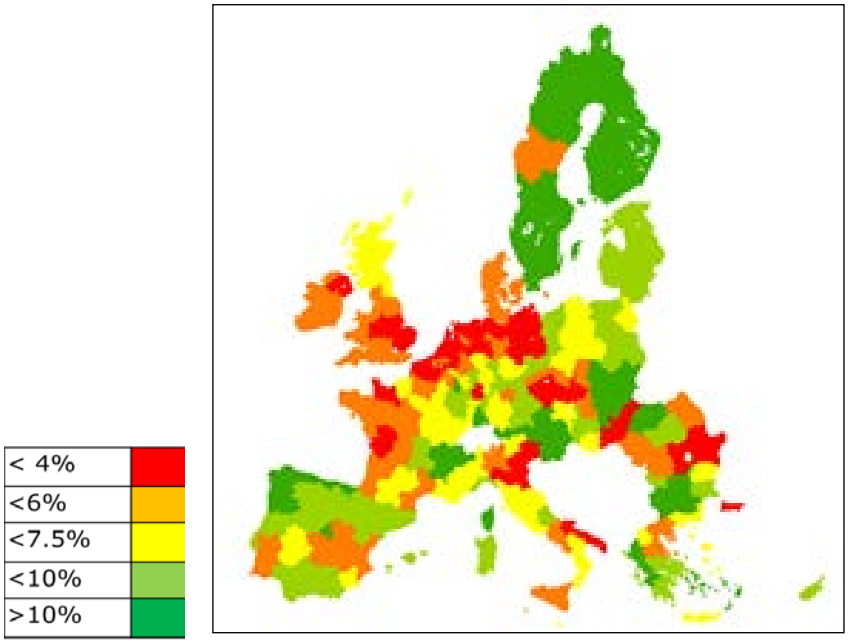


Figure 4: Percentage change in pasture area in 2020: A2 compared to A1

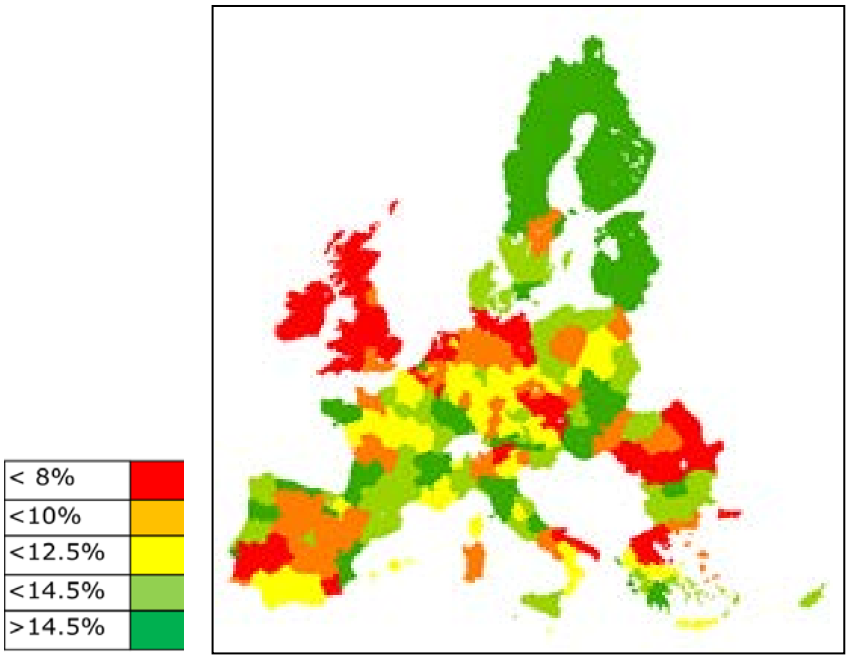
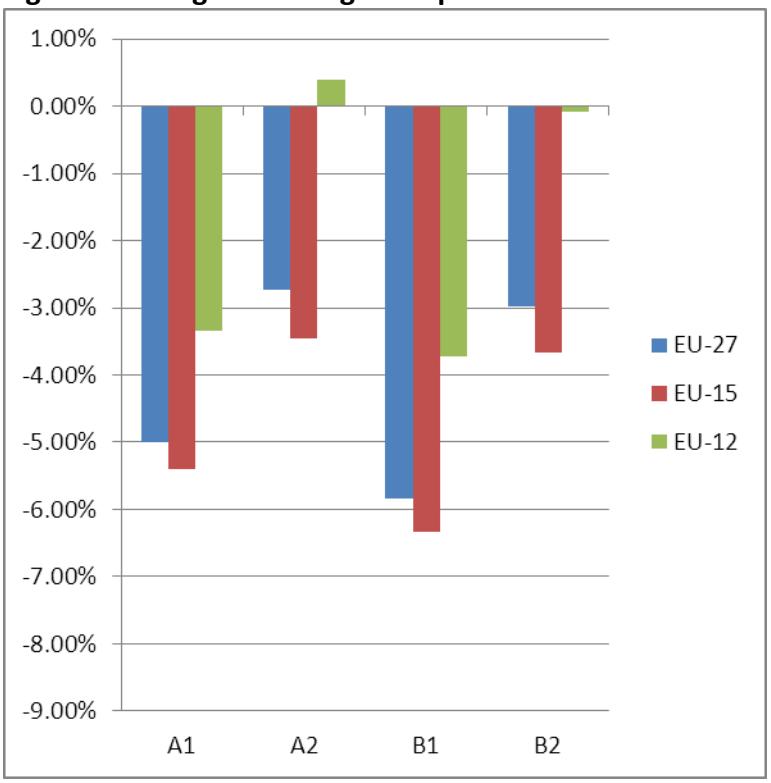


Figure 5: Changes in nitrogen surplus at soil level



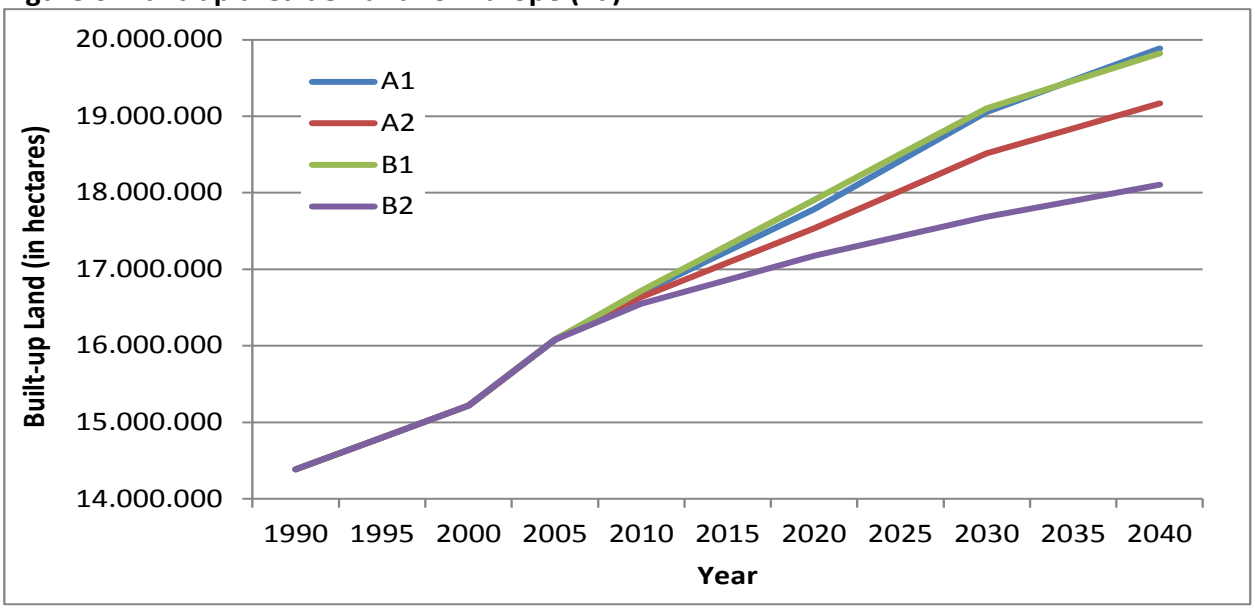
Demand for urban and built-up area for Europe has been delivered by JRC. "Built-up" area is defined as all types of artificial surfaces as delineated by all the land use/land cover classes under category 1XX of CORINE Land Cover (CLC), thus comprising the following elements:

Level 1		Level 2		Level 3		Built-up components
1XX	Artificial surfaces	11X	Urban fabric	111	Continuous urban fabric	Urban
				112	Discontinuous urban fabric	
		12X	Industrial, commercial and transport units	121	Industrial or commercial units	Industry & commerce
				122	Road and rail networks	Infrastructure
				123	Port areas	
				124	Airports	
		13X	Mine, dump and construction sites	131	Mineral extraction sites	
				132	Dump sites	
				133	Construction sites	
		14X	Artificial non-agricultural vegetated areas	141	Green urban areas	Urban
				142	Sport and leisure facilities	

"Built-up area demand" thus refers to the built-up surface area required by society to develop future economic activities. Temporal scope and resolution are from 2010 to 2040, in time steps of 10 years. Area demands are aggregated and compiled at the country level for all Europe. Demand takes three main components of built-up area into consideration: urban; industry and commerce; and infrastructure.

Figure 6 shows the aggregated results for all of Europe. Specific results are available for each country. These are fed into the CLUE model and then further downscaled.

Figure 6: Built-up area demand for Europe (ha)



	2006	2010		2020		2030		2040	
	hectares	4 year growth	hectares	10 year growth	hectares	10 year growth	hectares	10 year growth	hectares
A1	21.411.211	4,2%	22.317.798	7,2%	23.925.922	8,6%	25.984.225	6,0%	27.548.729
A2		3,9%	22.245.575	6,0%	23.579.236	6,7%	25.161.770	5,0%	26.418.072
B1		4,4%	22.352.020	7,8%	24.093.560	8,1%	26.043.362	5,3%	27.431.653
B2		3,3%	22.124.843	4,4%	23.087.971	3,9%	23.991.201	3,6%	24.863.989

Preliminary results for all four marker scenarios are also available for the forest growth model EFISCEN. While EFISCEN provides a larger number of indicators for the ecosystem service assessment in WP8, here we only provide two selective examples.

Figure 6 shows wood removals, i.e. the development of harvested volume of stemwood, based on demand for wood from domestic forests.

Figure 6: Wood removals (as calculated by EFISCEN)

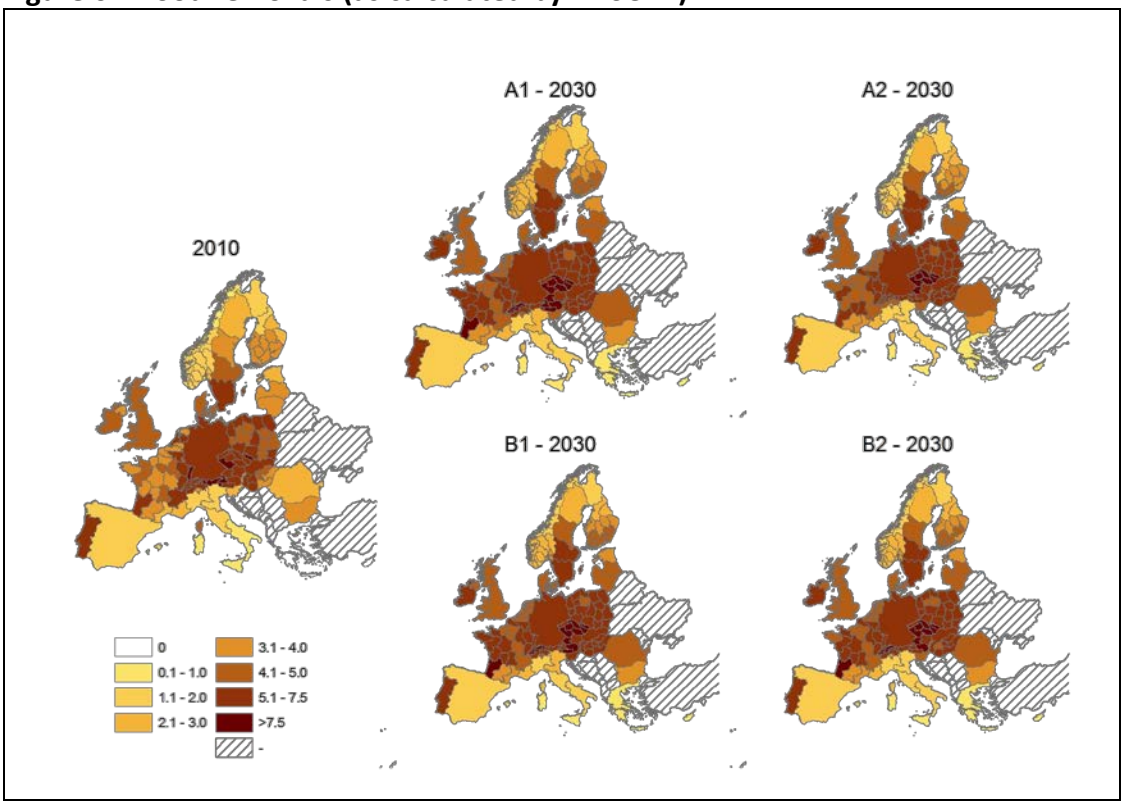
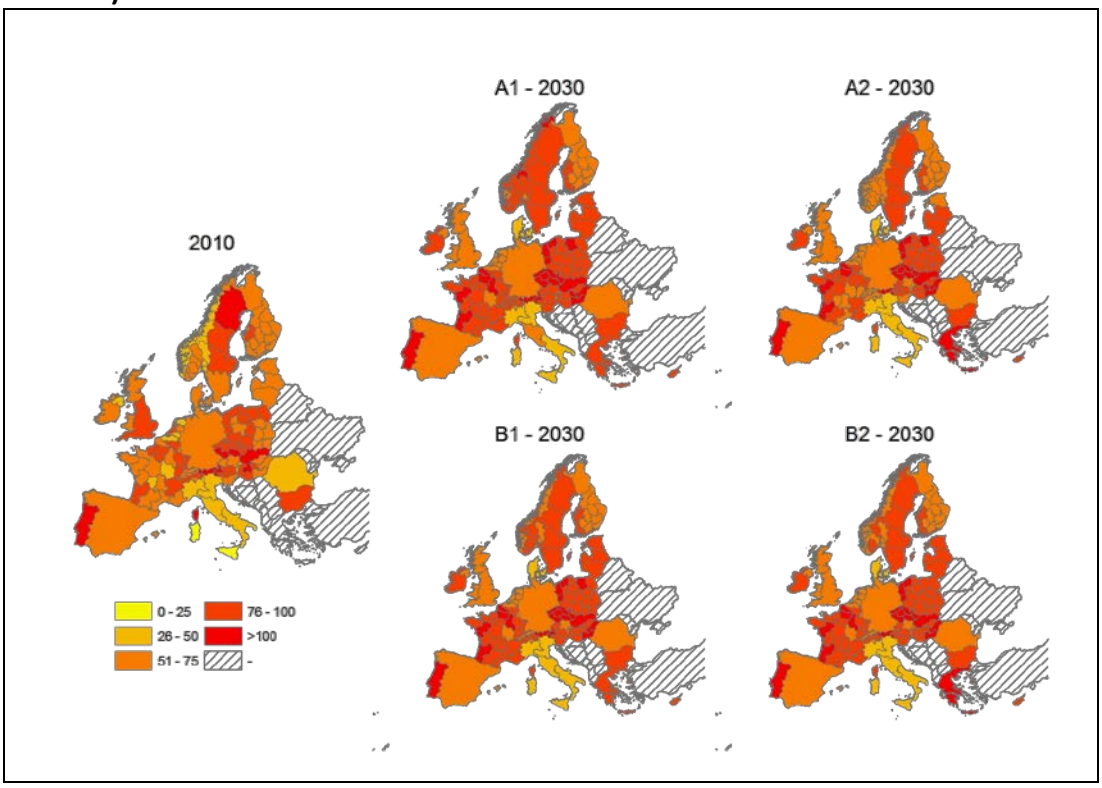


Figure 7 shows forest management intensity, i.e. the development of the amount of fellings (stemwood removals plus harvest losses) as a percentage of stemwood increment.

Figure 7: Forest management intensity (fellings relative to increment, as calculated by EFISCEN)



Finally, the described outputs from the economic models on changes in agricultural production, land use, and intensity, as well as results from JRC on changes in built-up area have been combined and fed into the CLUE land use allocation model. These results are still preliminary, for the following reasons: due to run-time restrictions, so far only marker scenario B1 could be finished; there needs to be further discussion on the changes in built-up area in some regions, since current changes appear to be quite dramatic in some instances; the main input on aggregate land use should come from CAPRI instead of LEITAP/MAGNET, which was not possible so far, due to some delays within the modelling chain. However, the available CLUE results provide a good impression on the potential for further analysis in the process of VOLANTE.

Figure 8 compares different land use types across all of Europe, for the B1 scenario in 2005 and 2040.

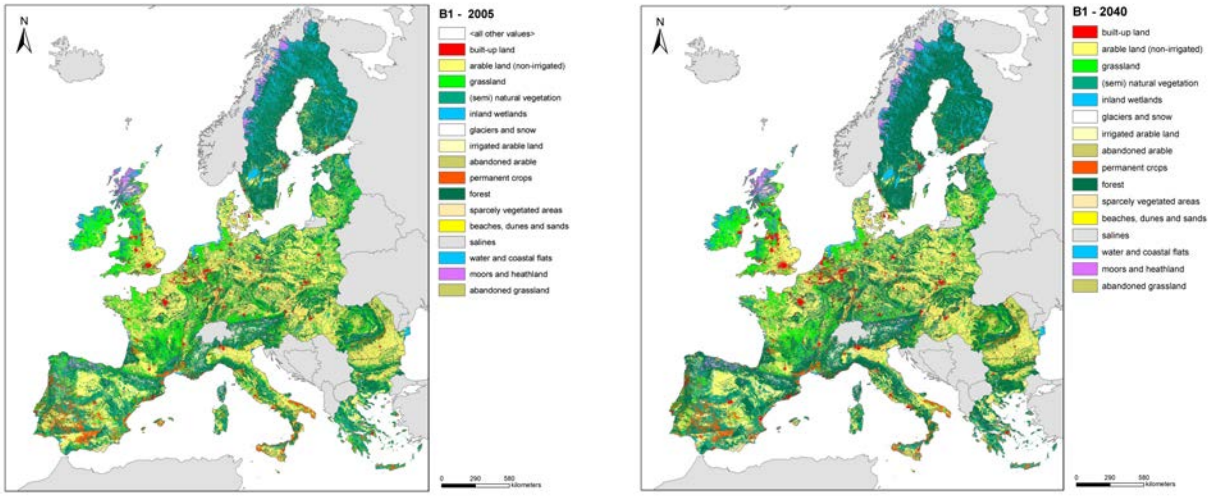


Figure 9 shows large conversion of semi-natural land into forest, with the example of Poland. This also occurs in parts of Sweden, Finland, the Alps and Pyrenees, South-East Europe, the Appennines and the Baltics. It needs to be discussed, whether this model results is realistic.

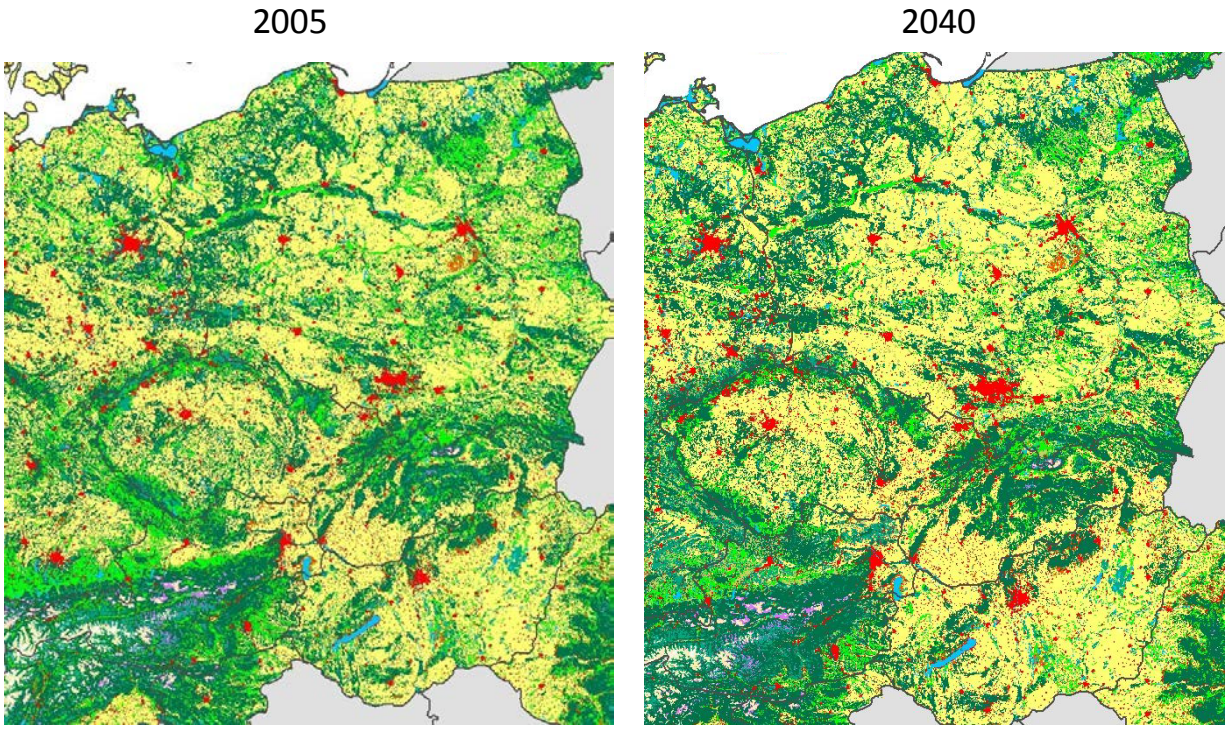
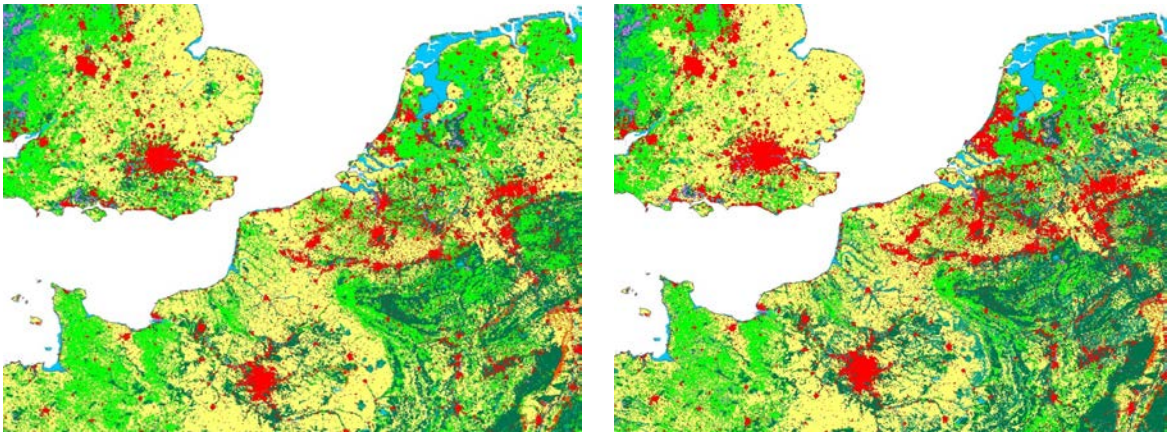
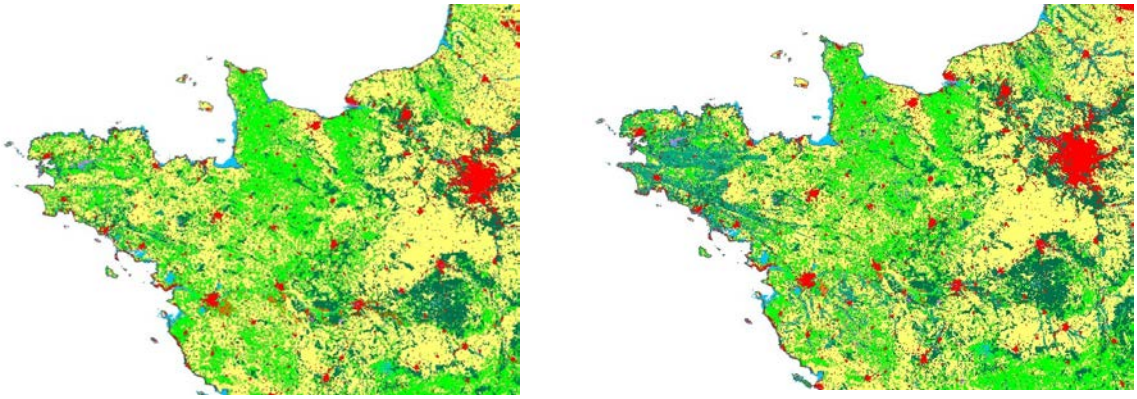


Figure 10 shows the clear trend of urbanisation across Europe, based on the JRC inputs. This seems especially pronounce in the UK, Irland, the Netherlands, and Spain. Dublin and Madrid are growing particularly fast. On the other hand, negativ development of urban areas is projected for parts of Romania, Slovakia, and Malta. These results and model interactions need to be further discussed between the project partners in WP7.



As a final example, **Figure 11** shows a trend of strong land abandonment, e.g. in parts of Bretagne and the Alps. This also needs some further discussion, based on more detailed information on e.g. farm structures in these areas.



These results also complete the top-down modelling chain, ranging from global macroeconomic changes to land use and land cover patterns for Europe at a very high spatial resolution. The four marker scenarios are close to be finished by all models in WP7. As a next step, a larger set of specific policy scenarios is now under development. The model-based assessment of the policy scenarios will provide a wider range of outcomes, in order to enable different pathways and coverage of a wide range of visions, as expressed in the stakeholder workshops.