

## Reviewer 1

### GENERAL REMARKS

The revised paper has satisfactorily and competently addressed most of the comments I have provided on the original paper.

The merit of the paper is twofold. First, it raises awareness regarding the importance of modeling paradigms and other model assumptions in determining the results the models produce, necessitating their careful and situated interpretation and cautious use in making policy decisions.

Second, by employing a systematic and focused comparison, it offers a comparative assessment of a top-down/aggregate with a bottom up/disaggregate model and discusses their relative worth and role in making decisions, despite the several open issues remaining for each modeling paradigm.

Moreover, the presentation and discussion of the models reveals the sensitivity of their results to the scenarios used and inputs from other models (see, e.g. section 2.2). The authors are careful to underline the coarse level at which models operate and limits their application to offering broad indications of potential land use change under several socio-economic and climatic scenarios. They also discuss several open issues that may be addressed, but also may not be addressed, in the context of these modeling exercises. A class of exogenous forces affecting land use change and may be probably tested at a coarse level concern disruptions owing to pandemics and major political events. These cause perturbations in labor supply, movement of people and products, tourism, etc. and may precipitate land use changes at a not-so-far future. It might be interesting to compare the aggregate and the disaggregate model predictions under these conditions to help further evaluate their overall significance.

Many thanks for the comments and suggestion about applications to coarse level disruptions, which we now mention in the conclusions section.

Selected, mostly editorial, comments are offered below.

ABSTRACT 11-13 “In this study, we compare two pan-European land use models that are based on the same integrated modelling framework and utilise the same climatic and socio-economic scenarios, but which adopt fundamentally different modelling paradigms.” It may be written more simply to avoid confusion: “In this study, we compare two pan-European integrated land use models, that utilise the same climatic and socio-economic scenarios, but which adopt fundamentally different modelling paradigms.”

Changed as suggested.

INTRODUCTION 41 “to guide models’ representation of human behavior” “to guide the representation of human behavior in models” reads better.

Changed as suggested.

58-59 “These previous comparisons reveal a major challenge: the shortage of models that take distinct approaches at similar geographical and thematic scales” What is a thematic scale? Did you want to write: “These previous comparisons reveal a major challenge: the shortage of models that take distinct approaches at similar geographical scales and thematic areas”?

Changed to “These previous comparisons reveal a major challenge: the shortage of models that take distinct approaches in similar geographical and thematic areas”

63 “Conceptual research suggests that...” What is conceptual research?

This is probably clearer without the reference to conceptual research, so we have now deleted it.

69-71 “We use the term ‘modelling paradigm’ here to refer to a coherent methodological and theoretical approach, and specifically the ‘top-down’ and ‘bottom-up’ approaches frequently identified as paradigms in the literature (Brown, Brown, & Rounsevell, 2016; Couclelis, 2002).” This sentence is unclear and confusing. Edit.

We have edited this sentence to read: “We use the term ‘modelling paradigm’ here to refer to a methodological approach that is based on a distinct theoretical description of the system in question; in this case ‘top-down’ and ‘bottom-up’ approaches frequently identified as paradigms in the literature (Brown, Brown, & Rounsevell, 2016; Couclelis, 2002)”

193-194 “We therefore also compare ecosystem service production levels, which account for exact forms of management simulated in each cell.” How exact can be a simulation of a form of management in a 16kmX16km cell?

Yes, the word exact was misleading; we have now changed it to “actual”, meaning the forms simulated in that cell rather than the generic label given to them.

TERMINOLOGY I suggest that instead of using the term ‘geographical’ to distinguish spatially disaggregate (spatially explicit) from aggregate analysis, the term ‘territorial’ is more suitable and supported by the fact that the spatially disaggregate estimates are using the NUTS classification scheme which is a territorial and not geographical scheme mainly. In the same spirit, I suggest replacing the term ‘overall land use change’ with ‘aggregate land use change’. The usage of these two terms – aggregate and spatially disaggregate (or, spatially explicit) – can be explained from the beginning and used consistently throughout the paper. See some examples below.

Thanks for the suggestions, and we have adopted both terminology changes.

3.1 Overall EU-level comparison You can write it as: EU-level aggregate comparison

Changed as suggested

3.2 Geographical comparison You can write it as: Territorial comparison

Changed as suggested

258 “Within the overall differences between model results exist some consistent spatial and geographical patterns (Fig. 4).” I suggest replacing ‘geographical’ with ‘territorial’

Changed as suggested

Fig 4: Geographical differences ... I suggest using ‘territorial’ instead of ‘geographical’

Changed as suggested

311-312 “The consequences of top-down and bottom-up perspectives are apparent in the forms, extents, rates and patterns of land use change as the models respond to scenario conditions.” Replace plural with singular number (form, extent, rate): “The consequences of top-down and bottom-up perspectives are apparent in the form, extent, rate and patterns of land use change as the models respond to scenario conditions.”

Changed as suggested

343 “All of the models’ results” reads better as “All the results of the models”

Changed as suggested

404 “we can only make tentative conclusions”, rewrite “we can only draw tentative conclusions”

Changed as suggested

Table captions should be placed on the top (not bottom) of the Tables

These were laid out following the journal’s template so we have left them where they are pending any further instructions.

Figure 1: Simplified schematic showing ... replace with Figure 1: Simplified schema showing ...

Changed as suggested

Figure 3a: Supply levels of services that both models attempt to satisfy demand for, in each scenario.  
Edit

Edited to read: “Supply levels of services that both models attempt to satisfy demand for. Supply levels are shown for each scenario, and demand levels (derived from the IAP) are indicated by a red line for each service.”

Similarly edit Figure 3b.

Edited to read “Supply levels of services that only CRAFTY attempts to satisfy demands for (while the IAP does not).”

Appendix B: Full geographical scenario results I suggest instead: Appendix B: Complete territorial scenario results.

Changed as suggested.

## **Reviewer 2:**

The authors have done a good job responding to the reviews and improving the manuscript. My only comment is that in the abstract you should be a bit clearer that your result is that the answer is EXTREMELY sensitive to the approach, perhaps try to be quantative about how different the amount (for example) of intensively managed land is for several scenarios. This answer is clear from the graphs, but I don't see these numbers in the text, so they should be added to the text, conclusions and abstract.

Thanks for the suggestion, which we have followed in the abstract, results and conclusions.