

**Referee report on revised submission of GMD manuscript “Simulating the effect of tillage practices with the global ecosystem model LPJmL (version 5.0-tillage)” by Lutz and Herzfeld et al.**

This work adds a significant and much needed capability to model impacts of tillage on various biophysical parameters that influence soil nutrient dynamics, crop yield and soil CO<sub>2</sub> and N<sub>2</sub>O emissions. The manuscript has gone through major update from the GMD discussions (GMDD) draft submitted previously. Authors have meticulously addressed and implemented all the relevant edits from both the reviewers to improve the quality of this paper significantly. For instance, new additions in finding presented in revised manuscript include dependency of crop yield on aridity, dependency of Carbon and Nitrogen dynamics on soil moisture and other relevant biophysical properties under different tillage and residual management practices. Discussion on crop yield, nitrate leaching and nitrogen dynamics previously absent, are now in text and as figures both. Revised manuscript improves on discussions of inferences from figures by explaining their link with variability in soil properties influencing the nutrient cycling. The impact of ‘soil infiltration’ has also been added in the modeling approach and clearly distinguished from ‘surface litter interception’ as suggested in GMDD peer-review. Revised manuscript emphasizes better on uncertainties and future scope in the modeling approach, critical for wider ecosystem modeling community to improve on this work. I only suggest some minor technical corrections:

- 1) Consider moving all appendix figures in your revised manuscript to supplementary document and re-upload it as new supplementary document. The older supplementary document is redundant. If you decide to keep it as appendix in main manuscript, please delete the older supplementary document still.
- 2) Remove typo on Line 604 of revised manuscript: (remove additional ‘e’ after ‘literature’)
- 3) Edit to ‘soil type-specific’ on Line 711 of revised manuscript
- 4) Mention %v as ‘percent by volume’ or ‘volume percent’ (Line 337) at first use, like you do for weight percent (%w) in Line 334 of revised manuscript