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Interactive comment on "A time-stepping scheme to simulate leaf area index, phenology, and gross primary production across deciduous broadleaf forests in eastern United States" *by* Qinchuan Xin et al.

Anonymous Referee #2

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A time-stepping scheme to simulate leaf area index, phenology, and gross primary production across deciduous broadleaf forests in eastern United States

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Authors present a scheme which can determine LAI for implementation in land surface models and illustrate its usefulness using the light use efficiency based production model. The paper is reasonably written but the scheme proposed is not as novel or well justified as the authors claim. In my opinion the manuscript needs a major

rewrite to bring out the usefulness of authors' scheme while keeping in mind the factors mentioned below.

My major comment is that it is not justified why equilibrium LAI should be a linear function of GPP. While it is certainly easy to do so and it is attractive from a modelling perspective – can the authors compile some empirical observations to justify this assumption. Second, much stress is laid on the new scheme which can determine LAI as the model runs forward in time. This is likely because authors' previous model did not do so. However, almost all land surface models which are implemented in climate models do so already. There is nothing unique about finding d(LAI)/dt on the fly as the model moves forward in time. As such then stressing "time stepping" in manuscript's title seems inappropriate. Third, the current land surface models used in climate models have phenology schemes which are already more complicated than what the authors' have proposed in this manuscript so the tone established in the Introductory section is also not entirely correct. What authors have proposed is a very simple and easy to understand phenology scheme. Simplicity is always appreciated as long as authors are aware of the limitations of their approach and these limitations are properly identified and documented. Finally, I am unclear about how the approach used by the authors can be applied in a modelling world where a model moves forward through time driven with meteorological data. For example, on Page 6 (line 26) authors say "Given the modelled LAI time series, both vegetation phenology and GPP can be easily retrieved". The use of the word "retrieved" is confusing. In a model, GPP depends on current LAI and the current time step's GPP is used to determine LAI for the next time step. It is unclear how this can be achieved in authors' framework.

I have several other minor comments and these are marked on an annotated version of the manuscript which I attach as a PDF file.

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2018-383/bg-2018-383-RC2-

supplement.pdf

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