

Interactive comment on “Climate change and elevated CO₂ favor forest over savanna under different future scenarios in South Asia” by Dushyant Kumar et al.

Anonymous Referee #1

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Dear Editor,

Review of the manuscript “Climate change and elevated CO₂ favour forest over savanna under different future scenarios in South Asia.

The manuscripts read well and has the most relevance topic covered for the day given we are experiencing unprecedented climate change impacts and resultant pandemic. The aim to look into this south Asian scenario on forest biomass and changing forest cover over the region given the major of the population are dependent on natural resources for their livelihoods. No doubt these models developed point at the future direction and provide policy makers sufficient time to plan and execute appropriate

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policies aiming to conserve limited natural resources and protect the livelihoods of millions.

The manuscript postulates that elevated CO₂ levels improve the C₃ function to enhance biomass productivity, which is quite simple to understand and model based on this assumption. However, at molecular level, the RUBP carboxylase has a different function based on the CO₂ concentration, temperature and sunlight. Photosynthetic enzyme RUBISCO has dual function that fixes carbon when there is higher concentration of CO₂ while at arid situations may act as RUBP oxygenase i.e., reduce carbon instead of fixing it. Thus, I request authors to go through the following articles which provide molecular basis of carbon fixation and how this might be helpful to model the scenarios under climate change.

1. James R Ehleringer and Thure E Cerling 2002, C₃ and C₄ Photosynthesis 2002 Volume 2, The Earth system: biological and ecological dimensions of global environmental change, pp 186–190 Edited by Professor Harold A Mooney and Dr Josep G Canadell in Encyclopedia of Global Environmental Change (ISBN 0-471-97796-9) Editor-in-Chief Ted Munn, John Wiley & Sons, Ltd, Chichester https://d1wqxts1xzle7.cloudfront.net/38426075/C3_ad_C4_photosynthesis.pdf?143913643;content-disposition=inline%3B+filename%3DC3_and_C4_Photosynthesis.pdf&Expires=1592uvohaB9ocTzsdth2Gg0pkJ3elFWyEmFKxx8GPH~hbRUY8GEXa-3HwNWKtzR33dLW~hGJlb-WPoisOwxVaU227JcrqW8SRNTEQx3-wbiRVSw4hMBzhwY7heqUnffNwPy7avhdQnZQ1DFRR5DxBGvSP76vxWFmkxNTPDiRC4TPair-Id=APKAJLOHF5GGSLRBV4ZA 2. Ian E. Woodrow and Joseph A. Berry 1988 ENZYMATIC REGULATION OF PHOTOSYNTHETIC CO₂ FIXATION IN C₃ PLANTS Ann. Rev. Plant Physiol. Plant Mol. Bioi. 1988. 39:533-94 <https://www.annualreviews.org/doi/pdf/10.1146/annurev.pp.39.060188.002533>

Furthermore, the manuscript under discussion line 349 (page 12) predicts expansion of woody forests compared to Savannas in mountainous regions. Similarly predicts that in Deccan plateau may change to evergreen forests from deciduous forests. This appears

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a very sweeping statement, given there is variation in rainfall associated with increasing temperatures Deccan region of the south Asia may experience floods and frequent droughts. It is well established that soils in Deccan region are low in nitrogen and other micro-nutrients, which support higher biomass production. I am not sure whether such physical attributes were considered while modelling the forest cover change. In fact, the regions of the deccan plateau currently experience severe droughts which may cast uncertainty of the results obtained by the Authors. Under these situations the conclusions drawn seems to be quite simplistic without applying appropriate knowledge in the forestry sector. The authors at page 13 line 376 explain aptly that decreased biomass due to various limitations of rainfall and other conditions in the plant photosynthetic process contracts the previous conclusions. Thus authors are making simplistic claims without considering the holistic impact of CO₂ increasing concentrations on the biomes that are less studied at the molecular levels and at the experimental forest dynamics due to changing temperatures. Overall, I confirm that current level of understanding and justifications provided does not warrant the publication of this article.

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