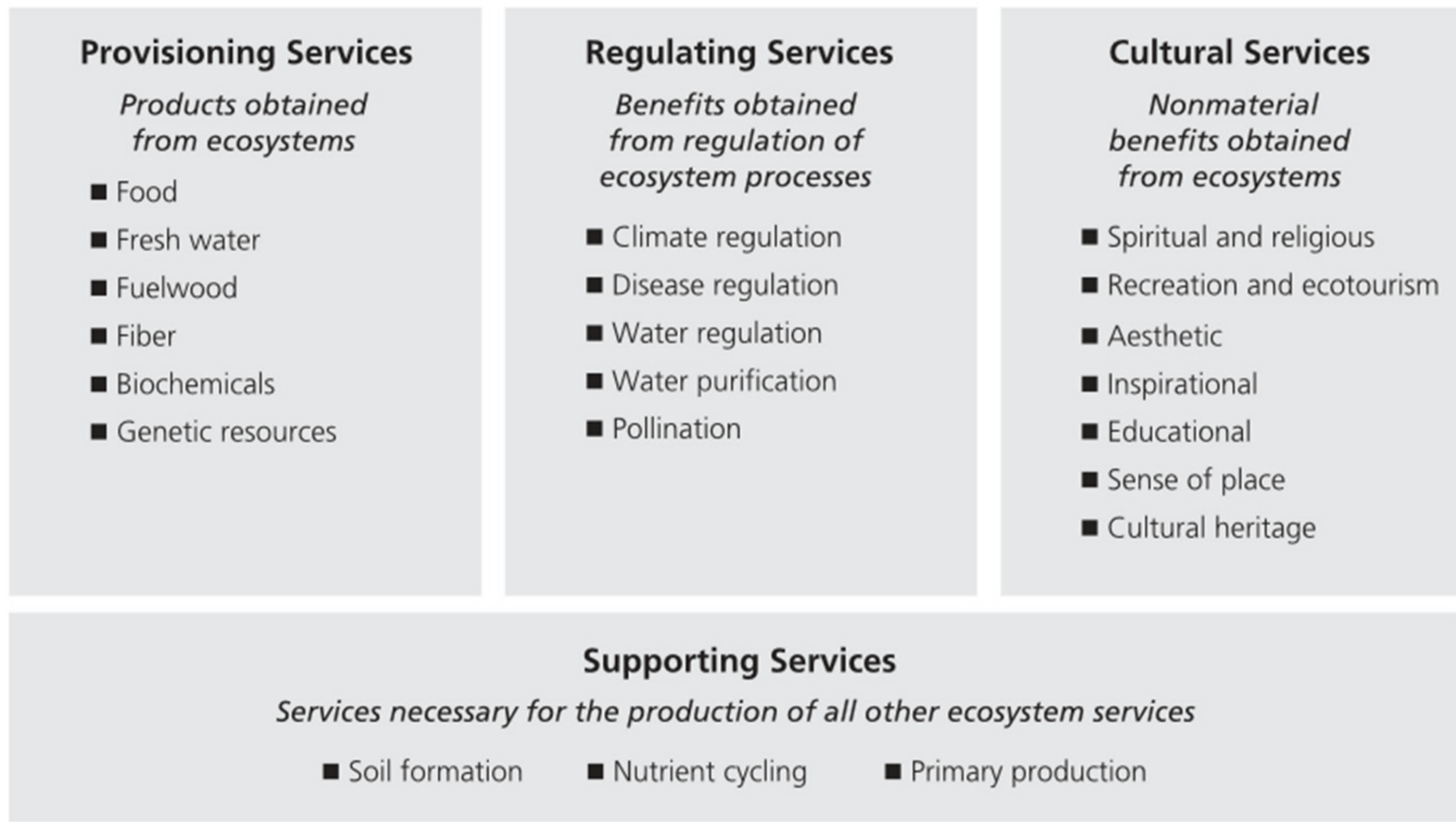
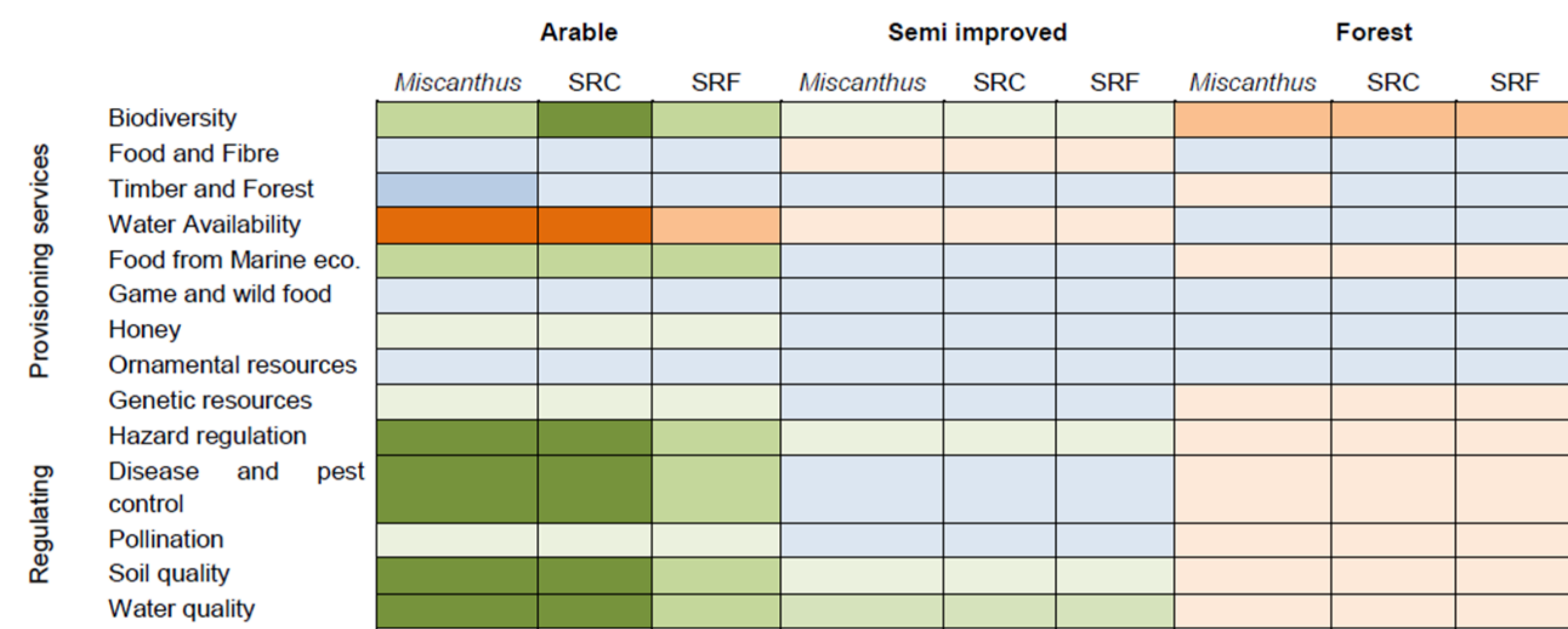
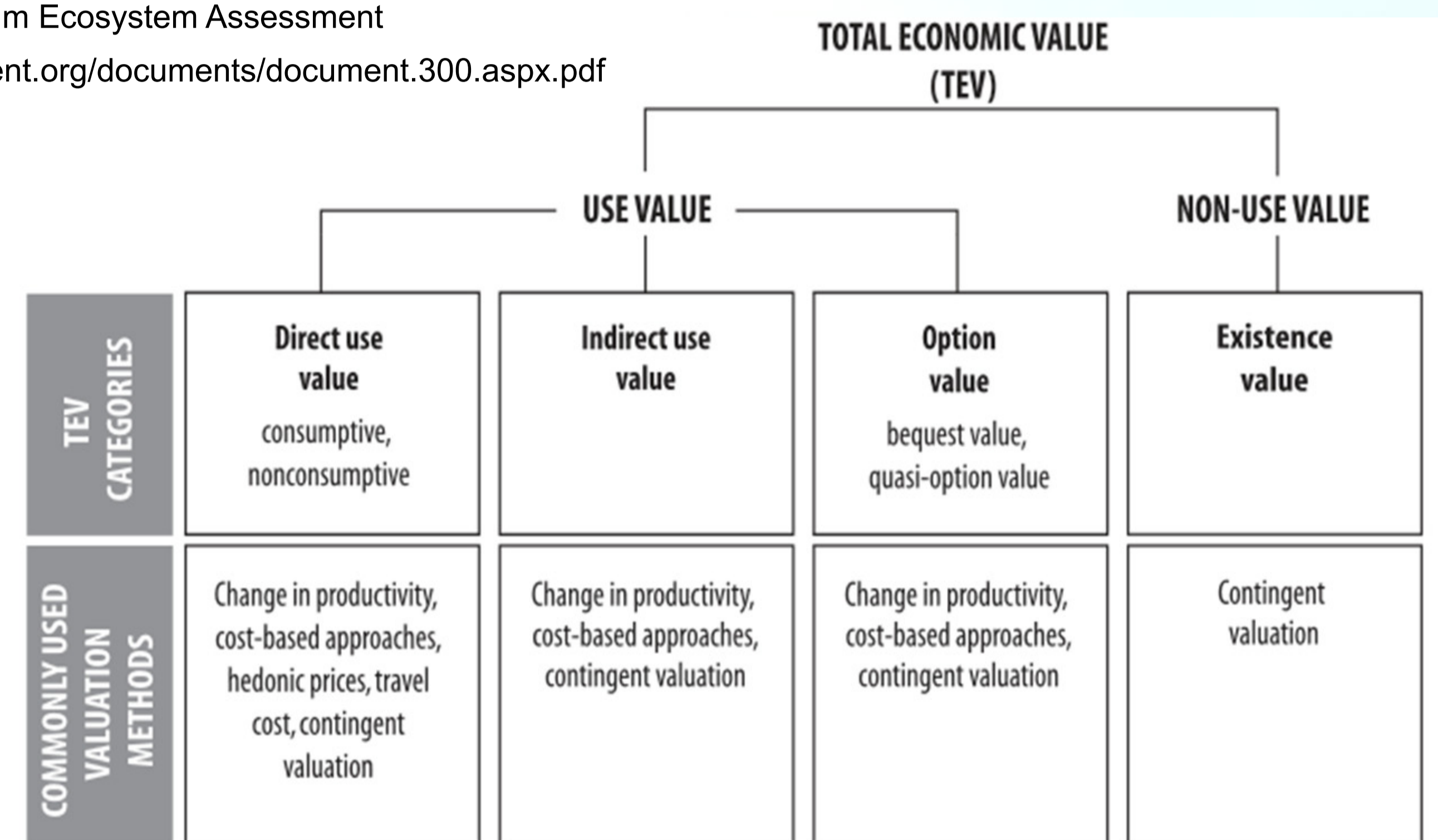


# MODELLING IMPACTS OF SECOND GENERATION BIOENERGY CROPS ON ECOSYSTEM SERVICES

COMBINING BIOGEOCHEMICAL MODELS (ECOSSE, DAYCENT) WITH BIOENERGY CROP MODELS (MISCANFOR, SALIXFOR) AND BIODIVERSITY (LEFT, ECOSET) AND ECOSYSTEM ASSESSMENT AND VALUATION TOOLS (FRAMEWORKS, THREAT MATRIXES) TOWARDS AN UNDERSTANDING OF IMPLICATIONS, SYNERGIES, AND TRADE-OFFS UNDER CLIMATE CHANGE. OUTPUT WILL BE VIZUALISED WITH ARCGIS AND GOOGLE EARTH ENGINE FOR A BETTER UNDERSTANDING WHERE BIOENERGY CROPS SHALL BE USED OR BETTER AVOIDED OVER THE NEXT DECADES TO MITIGATE IMPACT OF CLIMATE CHANGE.

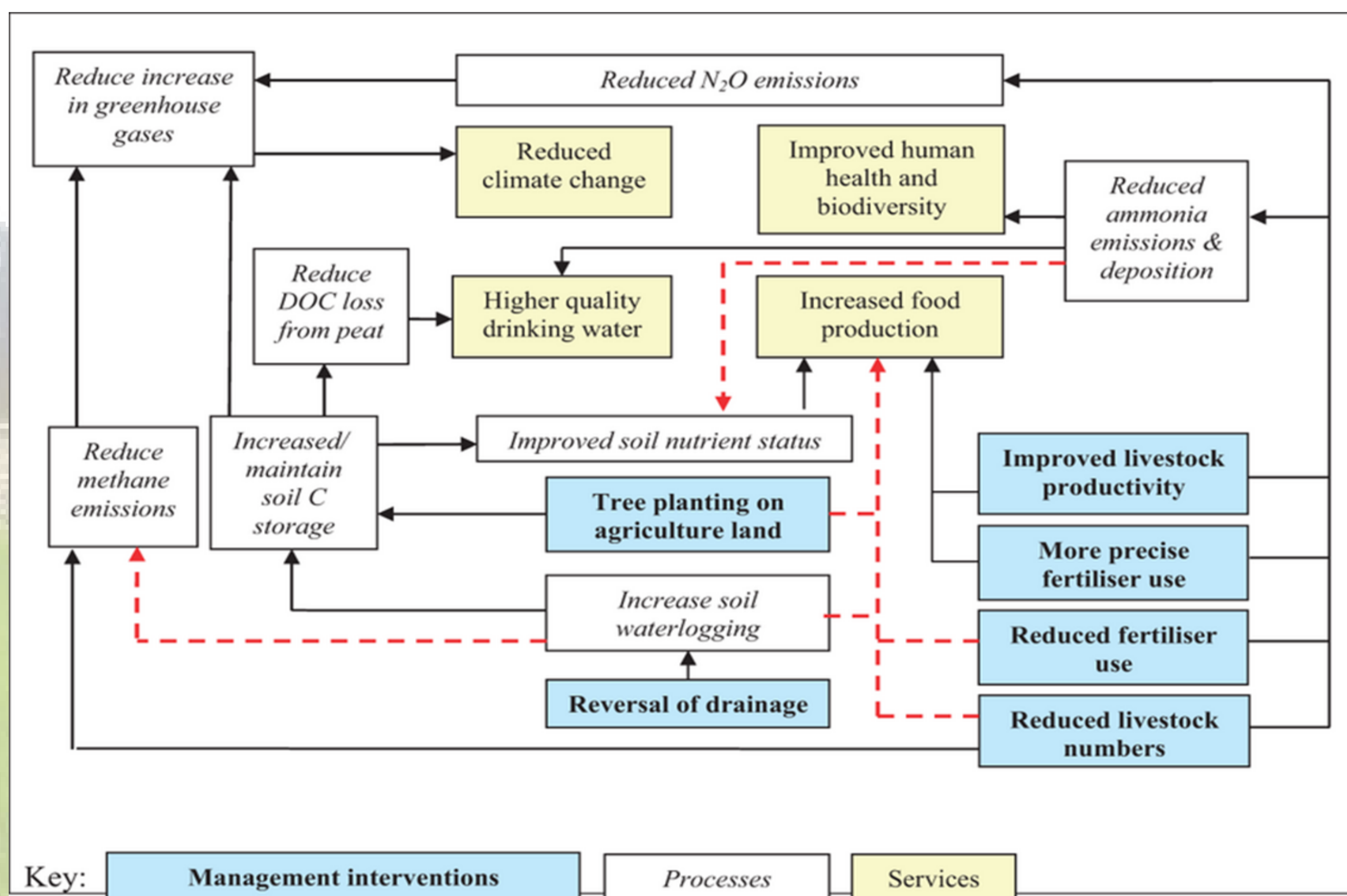


Source (left and right): Millennium Ecosystem Assessment  
<http://www.millenniumassessment.org/documents/document.300.aspx.pdf>



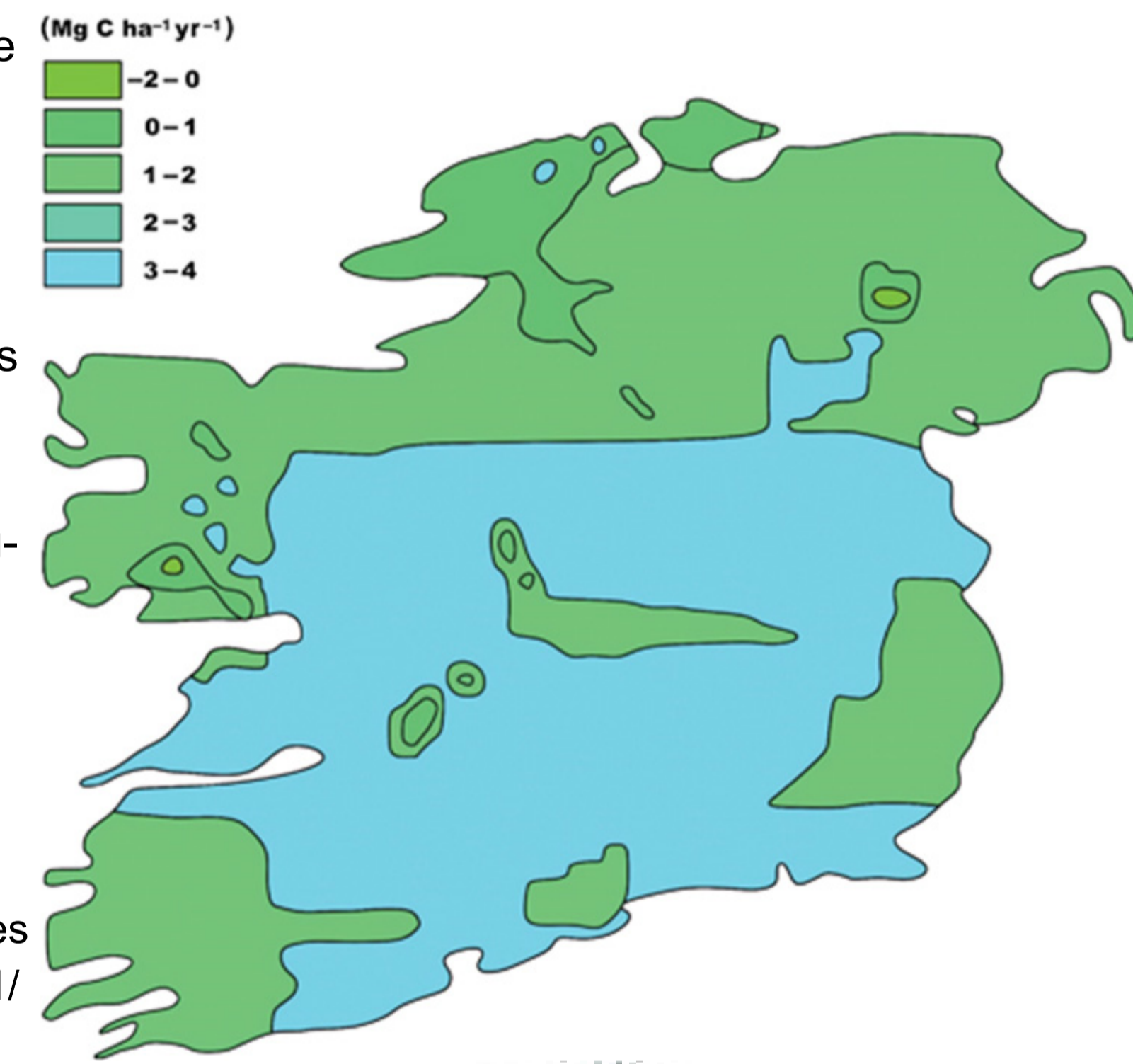
KEY  
Effect: Positive (Green), Neutral (White), Negative (Red)  
Confidence: Low (Light), High (Dark)

Source: Ecosystem Land-Use Modelling & Soil C Flux Trial (ELUM). Review of the Effects of Bioenergy Crops on Ecosystem Service in the UK Context. Robert Holland, Donna Clarke and Gail Taylor (2013) Faculty of Natural & Environmental Sciences, University of Southampton, Southampton, SO17 1BJ

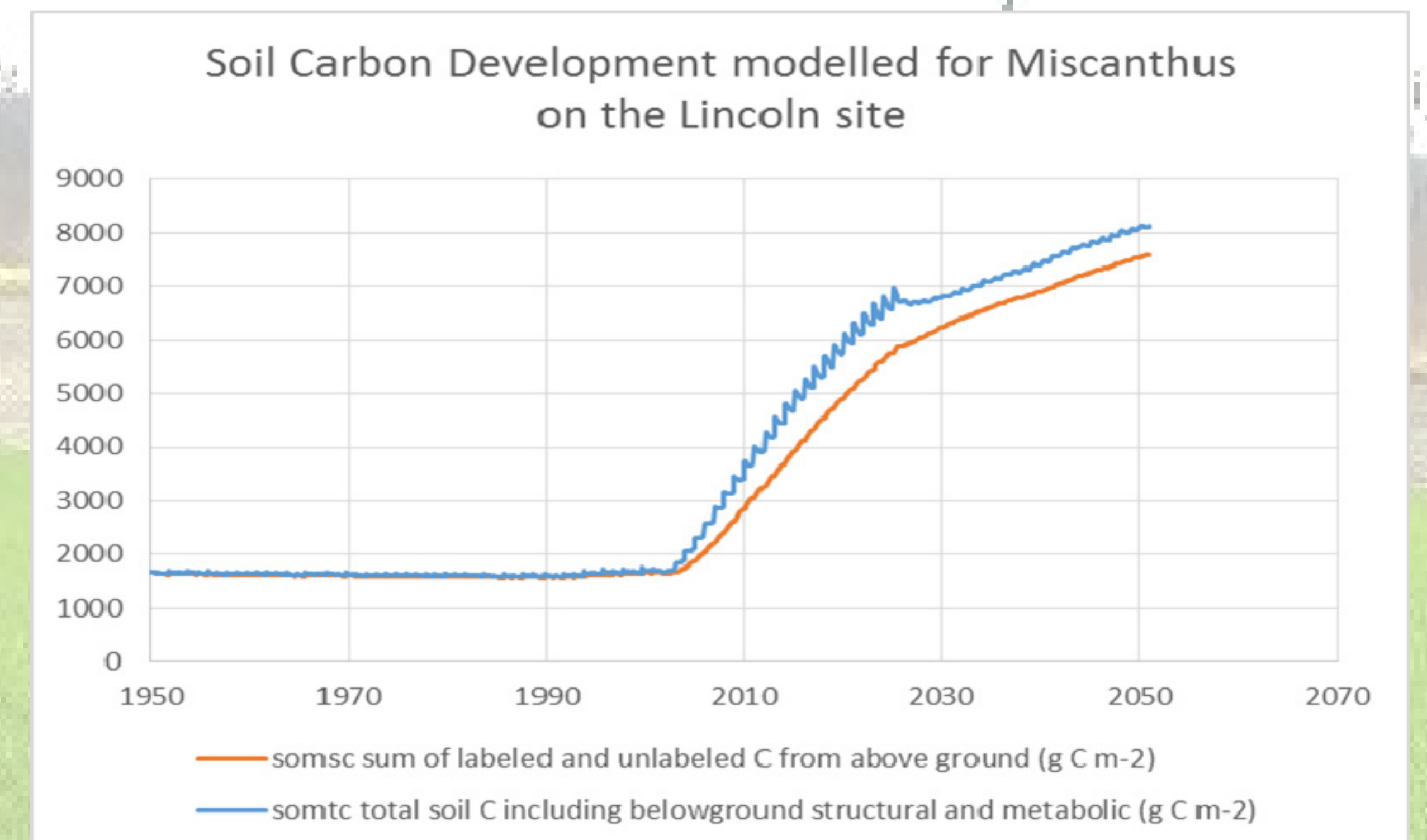


Source: Smith et al (2012) The role of ecosystems and their management in regulating climate, and soil, water and air quality Journal of Applied Ecology Volume 50, Issue 4, pages 812-829, 21 DEC 2012 DOI: 10.1111/1365-2664.12016. <http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12016/full#jpe12016-fig-0001>

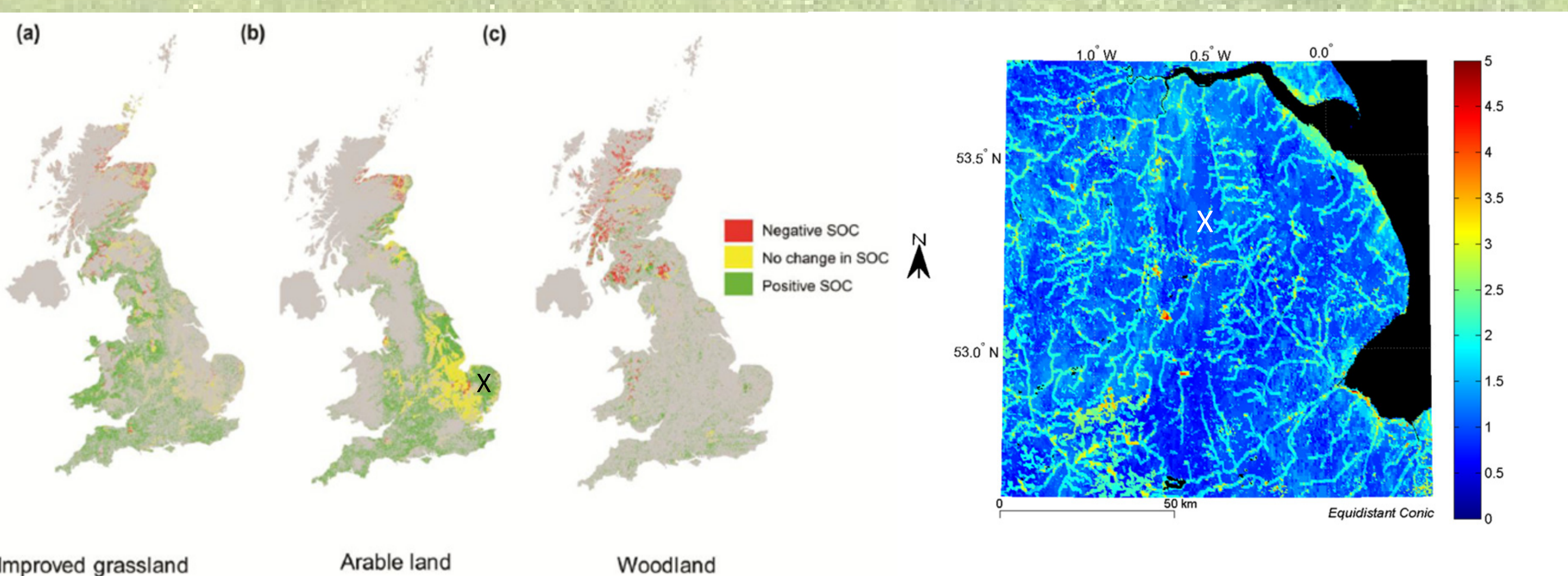
Carbon mitigated by an increase in soil organic carbon from the plant residue input from a Miscanthus bioenergy plantation. This value is calculated from input from Miscanthus plant debris calculated by the MISCANFOR model and its decomposition along with the initial soil carbon using the cohort model. The mitigation is expressed in Mg C ha<sup>-1</sup> y<sup>-1</sup>.



Source: Dondini et al (2010) GCB Bioenergy Volume 1, Issue 6, pages 413-425, 2 FEB 2010 DOI: 10.1111/j.1757-1707.2010.01033.x



An example of combined results of modelled SOC and biodiversity threat shows that Miscanthus has a positive effect on SOC at Lincoln site (cross on left graph) where biodiversity threat is relatively low (see graph on right). The least areas with synergetic effect are found following land use change from woodland, the widest possible effect follows land use change from other arable use. It will be crucial to combine climate change with this scenario because precipitation can have an effect on this as shown.



Source: Milner et al (2015). Potential impacts on ecosystem services of land use transitions to second generation bioenergy crops in UK. GCB Bioenergy. doi: 10.1111/gcbb.12263

Source: University of Oxford. <http://www.biodiversity.ox.ac.uk/researchthemes/biodiversity-technologies/assessing-ecological-value-of-landscapes-beyond-protected-areas-left/>

## MONTHLY N<sub>2</sub>O FLUXES AT THE LINCOLNSHIRE SITES - COMPARISON MODELLED AGAINST MEASURED SHOWS THAT MODEL DOES NOT YET EXACTLY FOLLOW HEAVY PRECIPITATION EVENT IN AUTUMN 2013

