U.S. DEPARTMENT OF ENERGY | Office of Science

Climate Change SCIENCE INSTITUTE

Influence of prognostic land use on 21st century climate prediction

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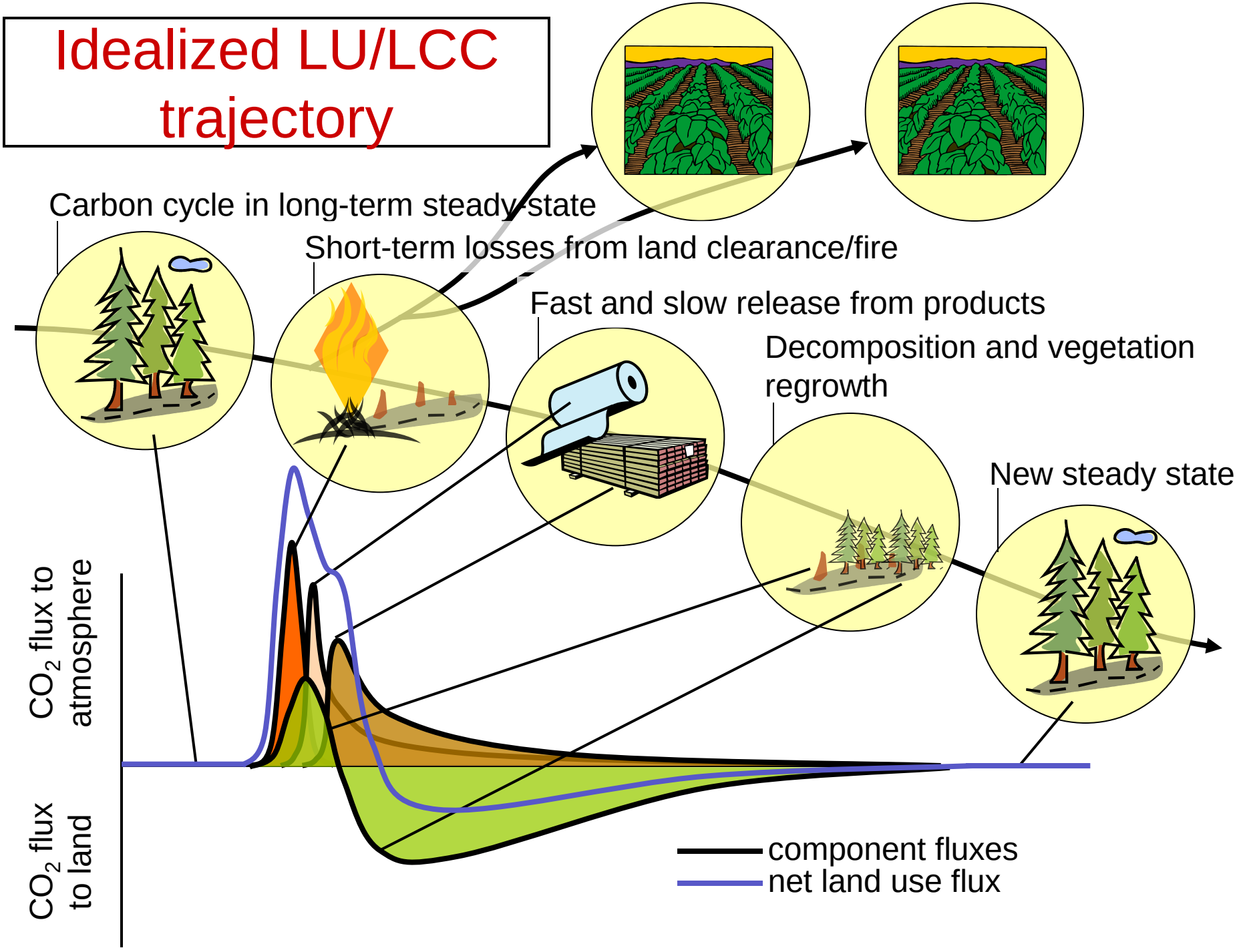
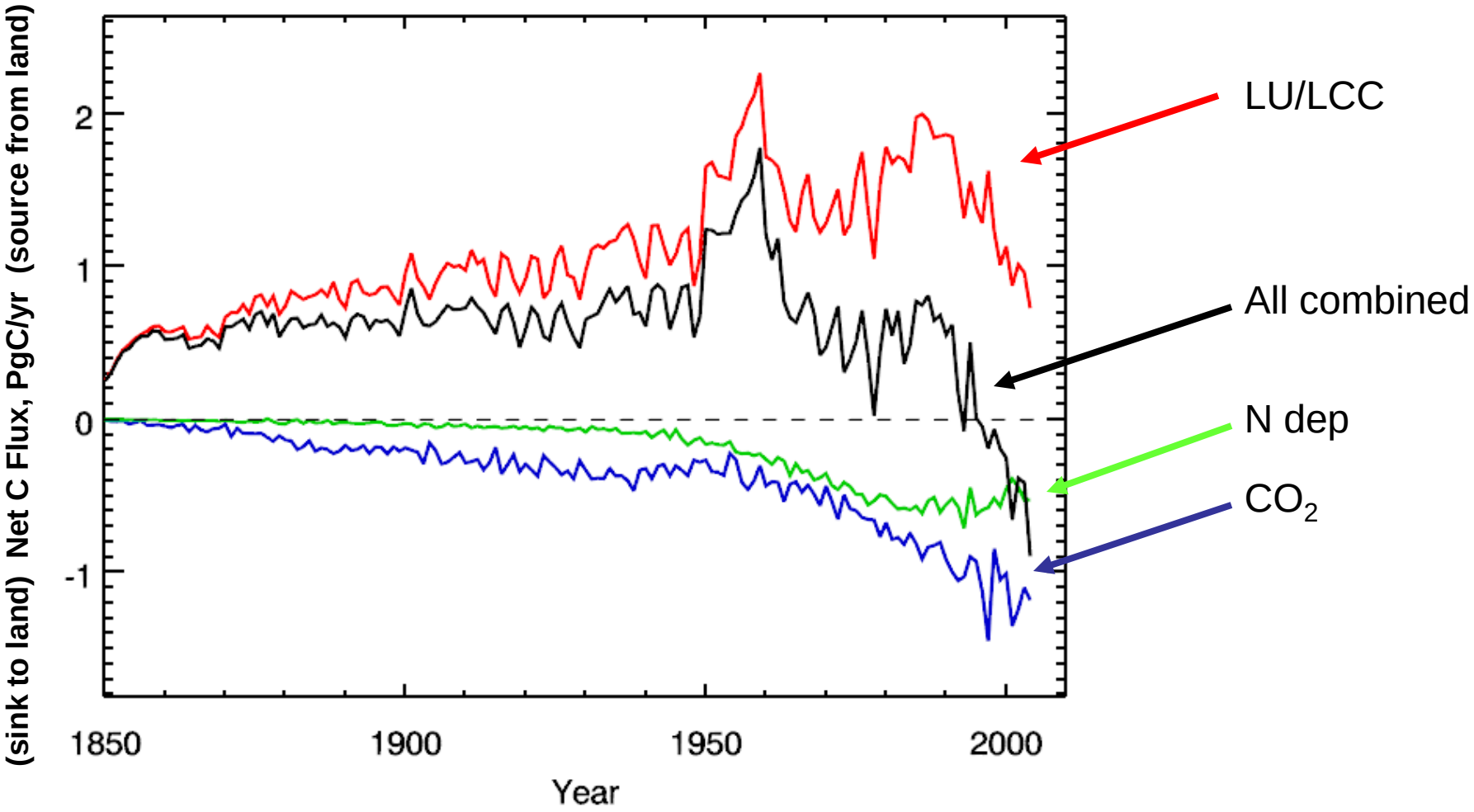
Coupling an Integrated Assessment Model with an Earth System Model: Why bother?

- Land use and land cover change (LU/LCC) are significant drivers of GHG fluxes and physical climate feedbacks
- Social, economic, and policy factors are important drivers of LU/LCC.
- Socio-economic scenarios used to assess the potential extent and impacts of future climate change make strong assumptions about LU/LCC.

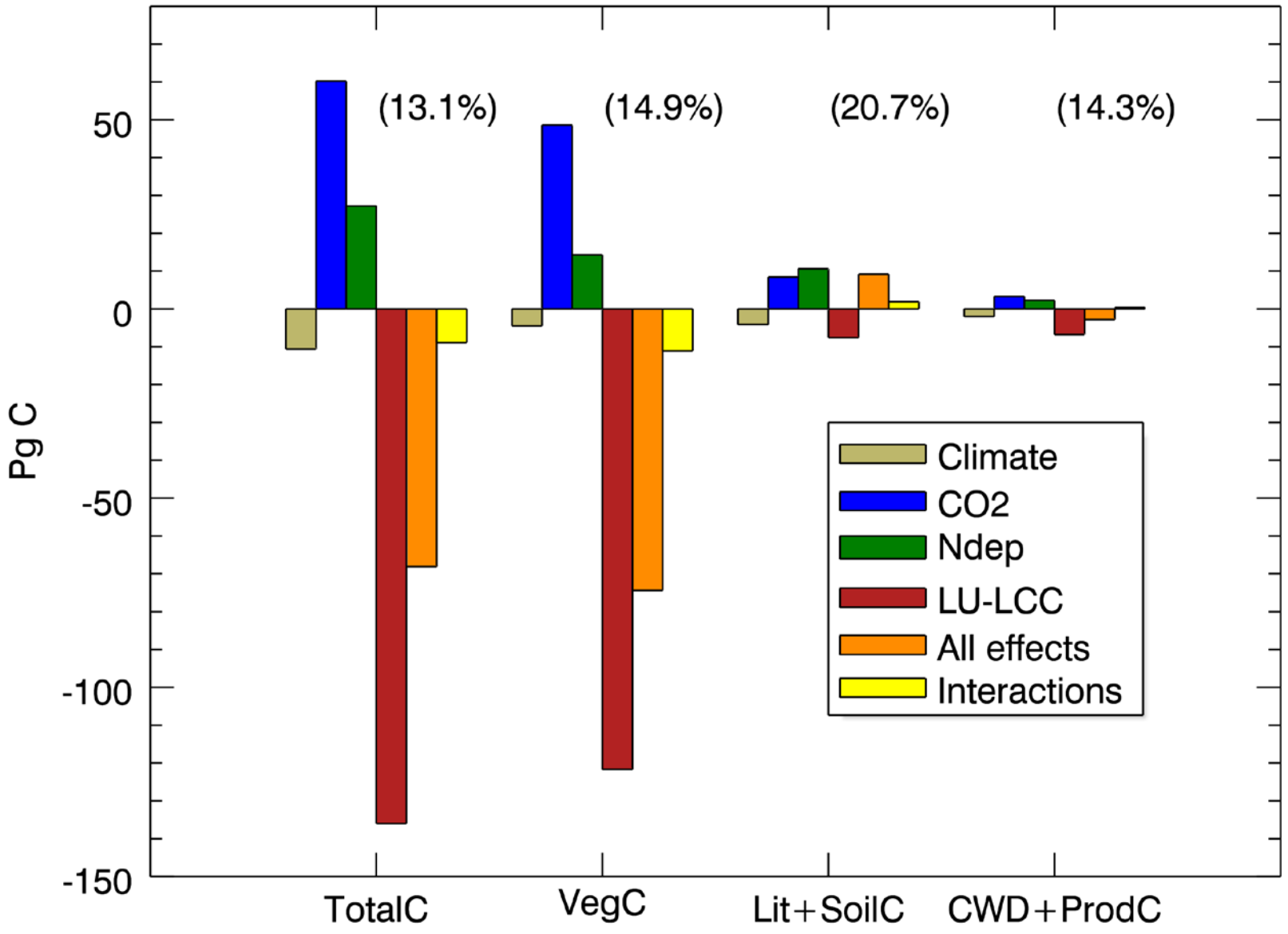
Idealized LU/LCC trajectory



Relative importance of LU/LCC as a driver of net land carbon flux



Impacts on total land carbon stock, 1850-2009



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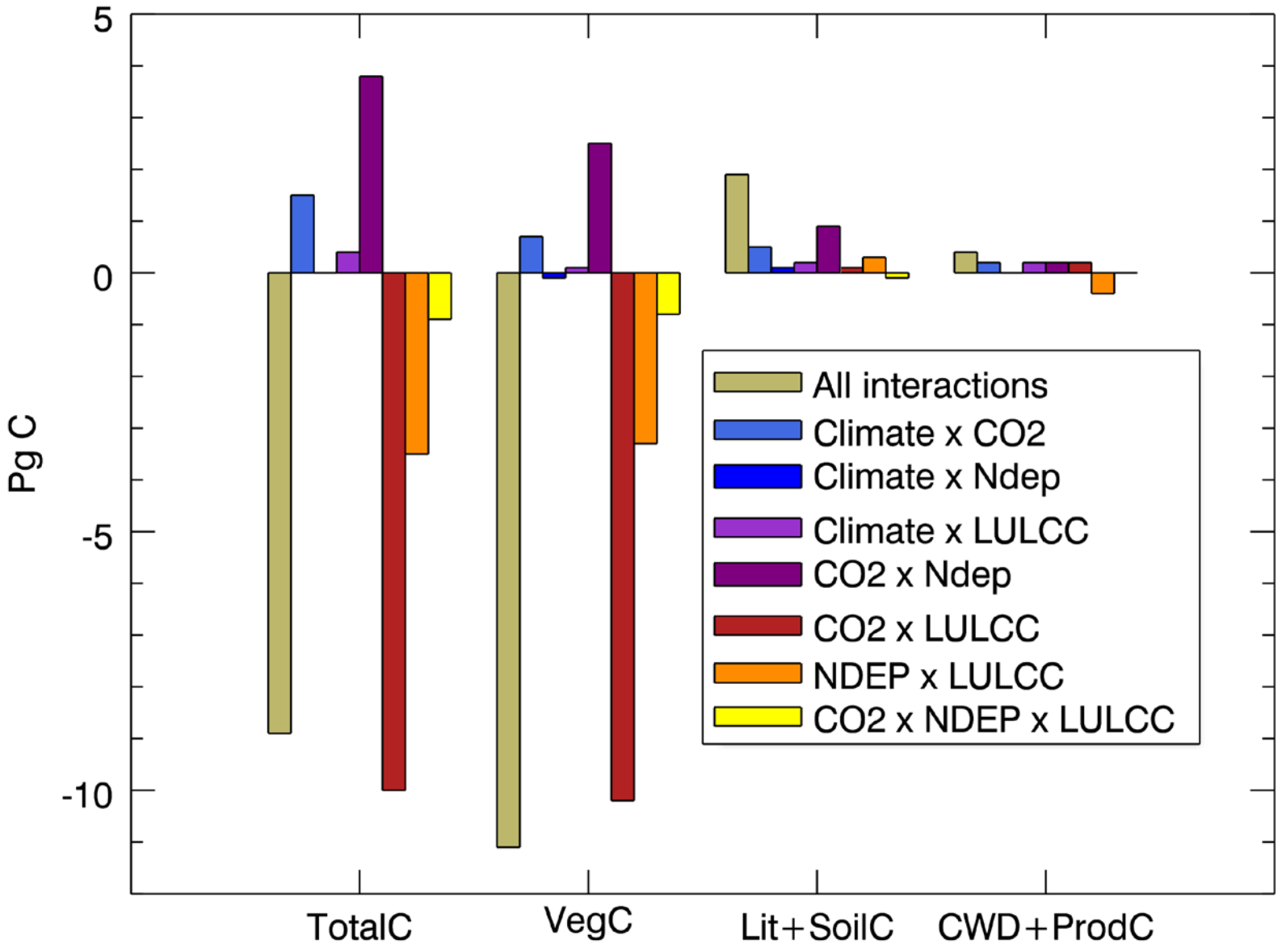
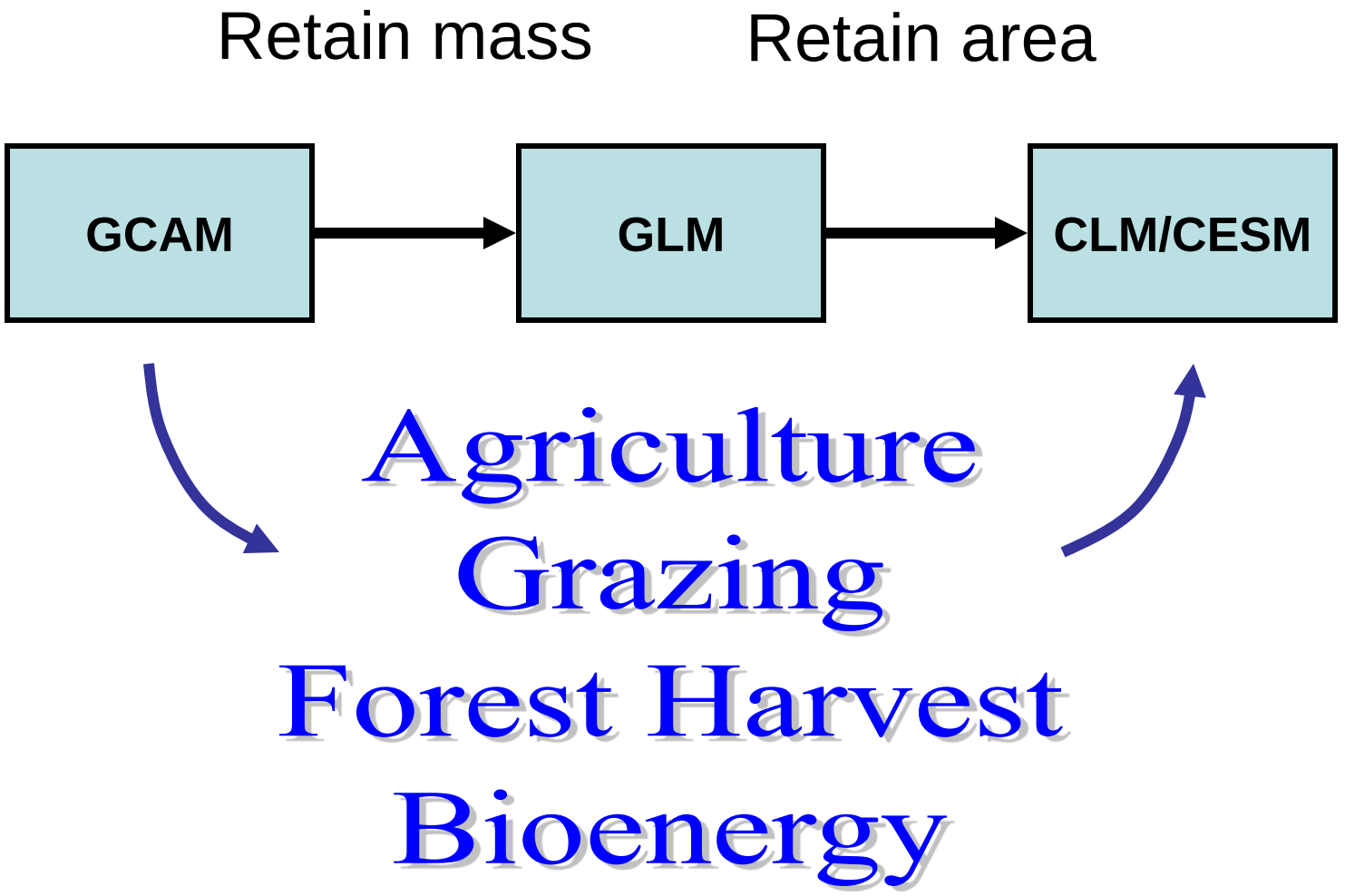
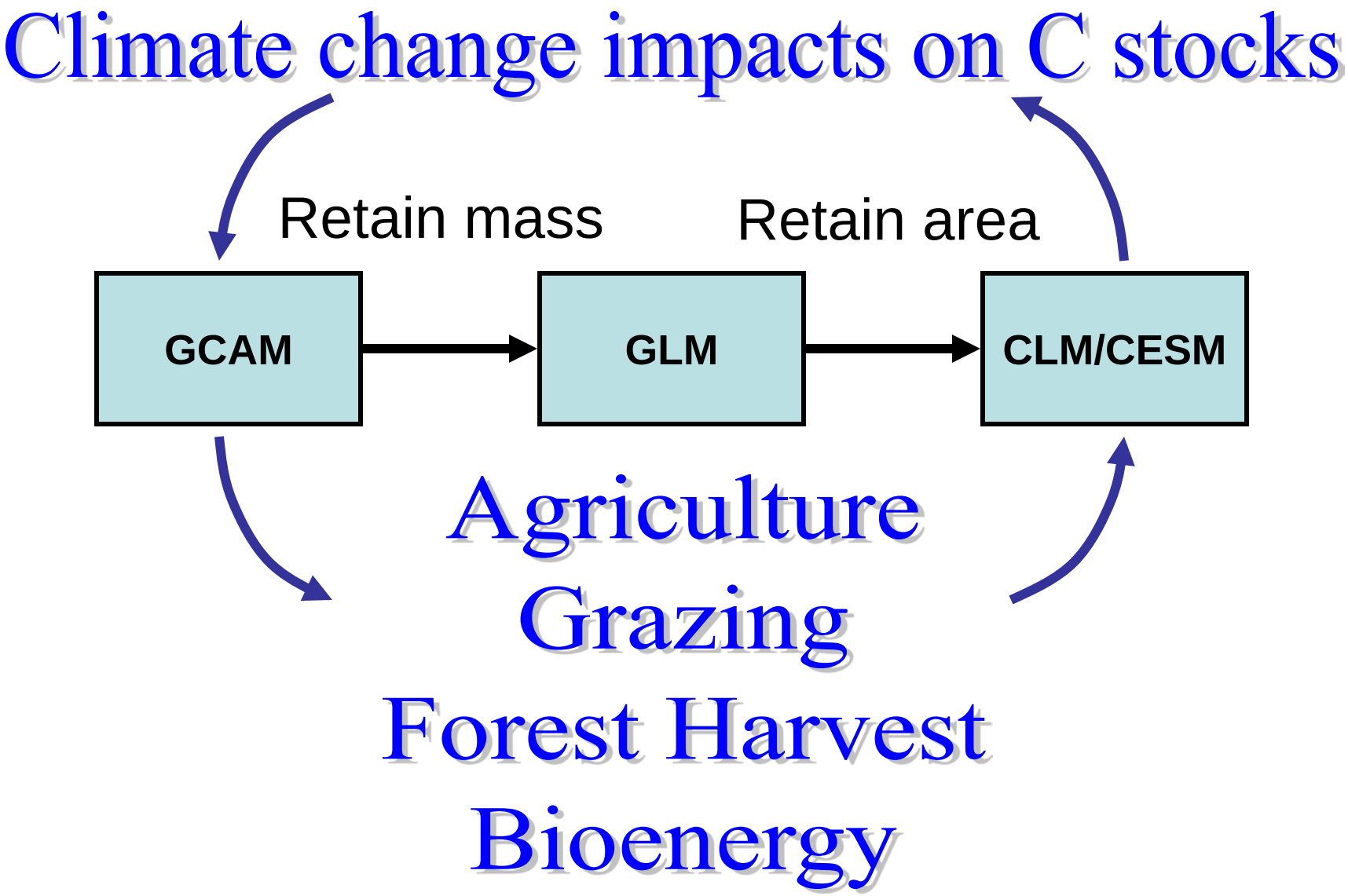


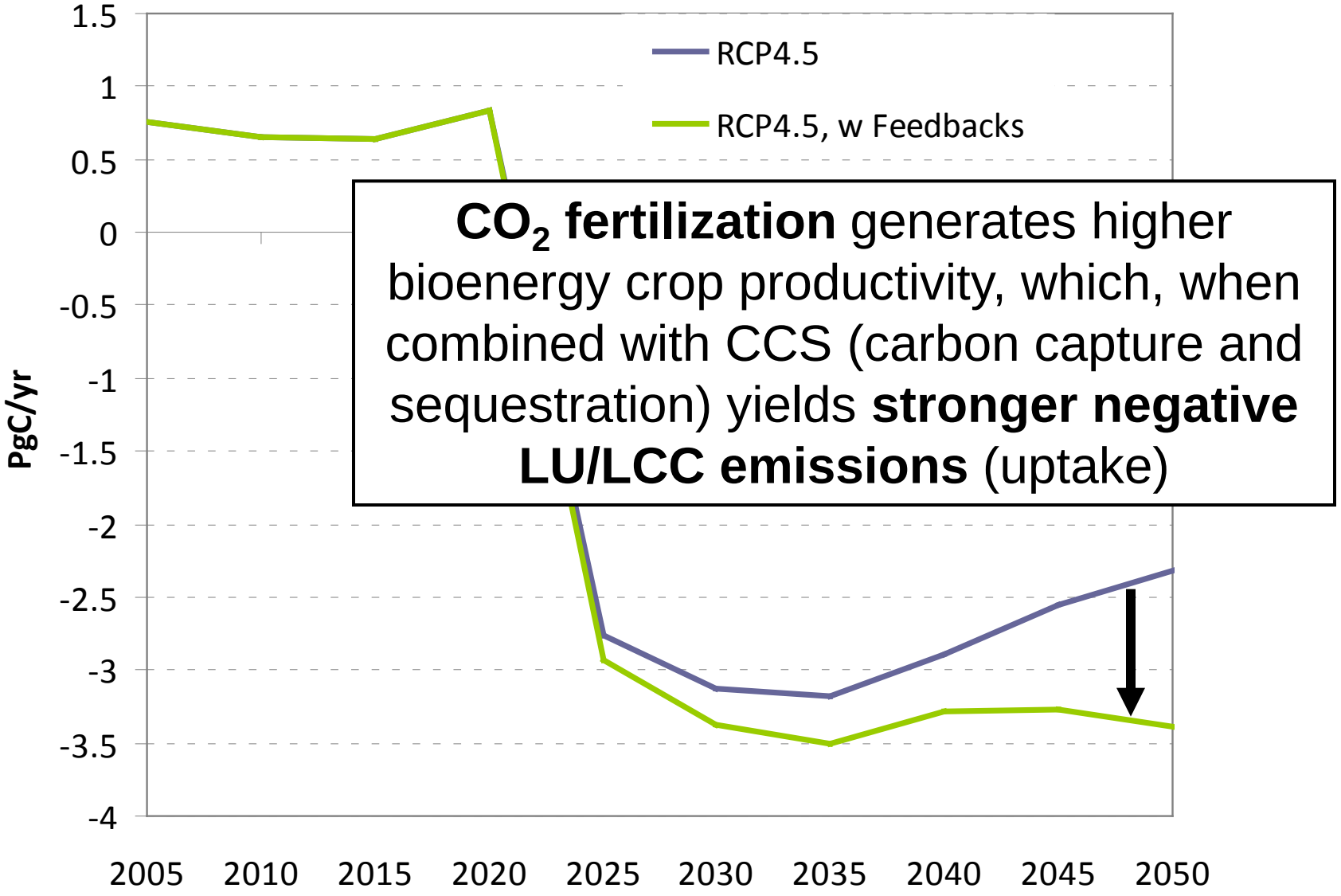
Standard coupling strategy



Integrated coupling strategy

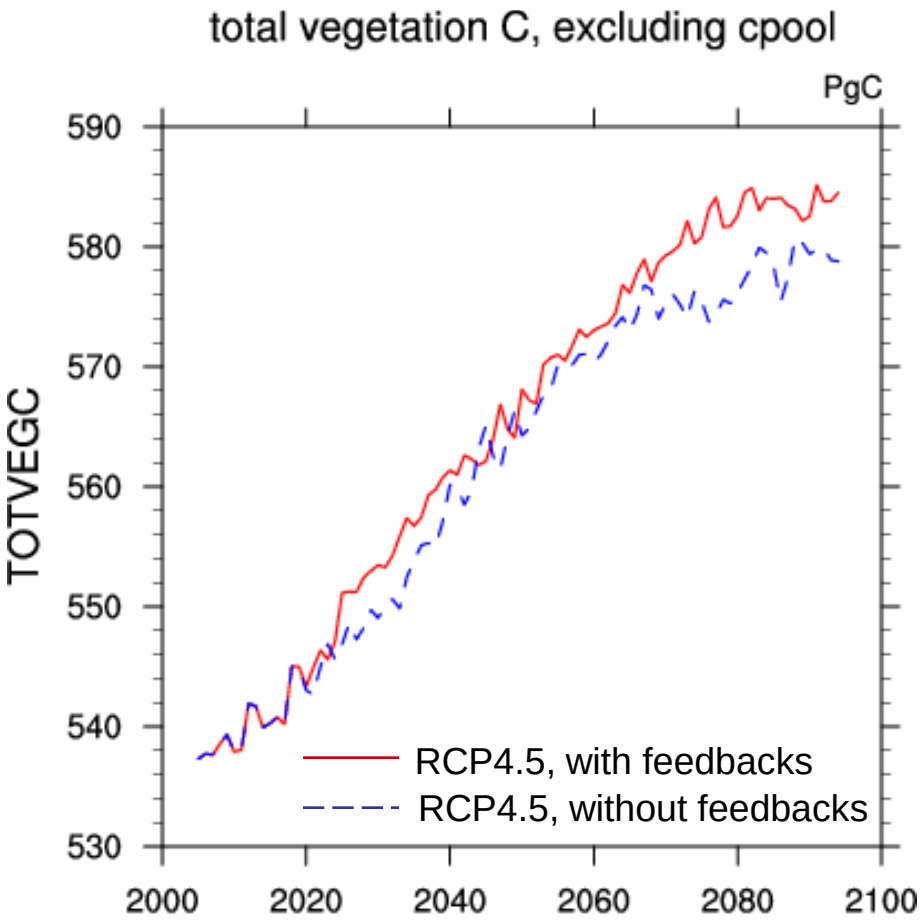


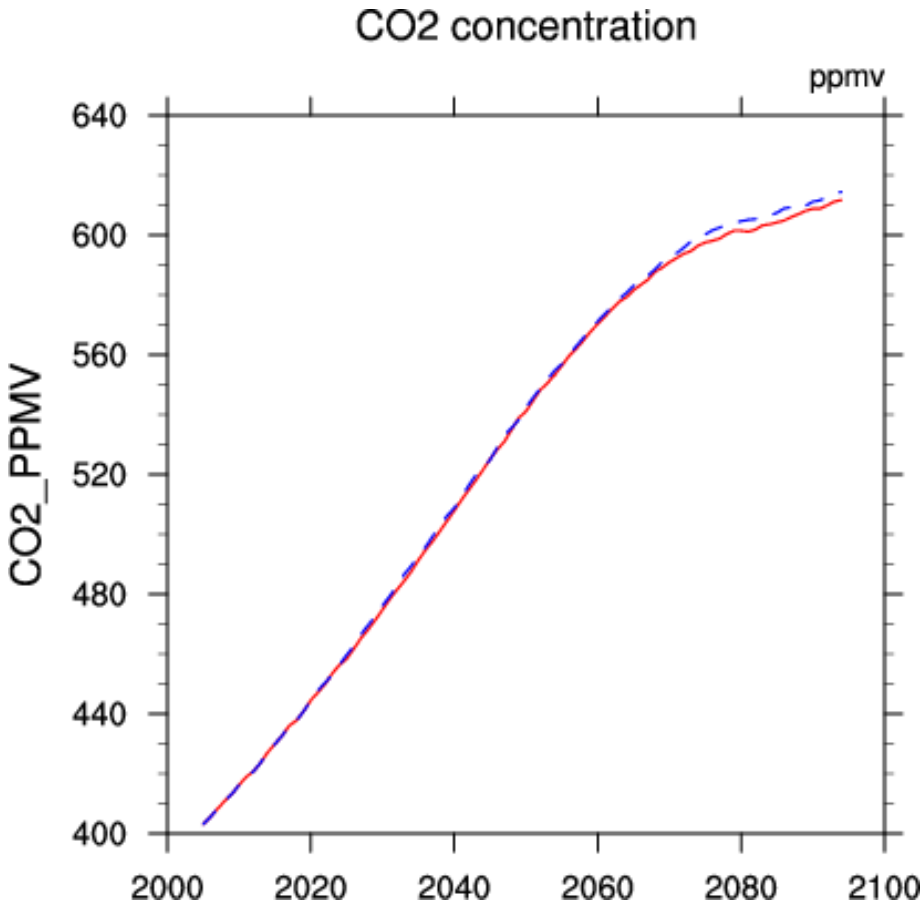
Impact on GCAM predictions: LU/LCC emissions



CO_2 fertilization generates higher bioenergy crop productivity, which, when combined with CCS (carbon capture and sequestration) yields **stronger negative LU/LCC emissions** (uptake)

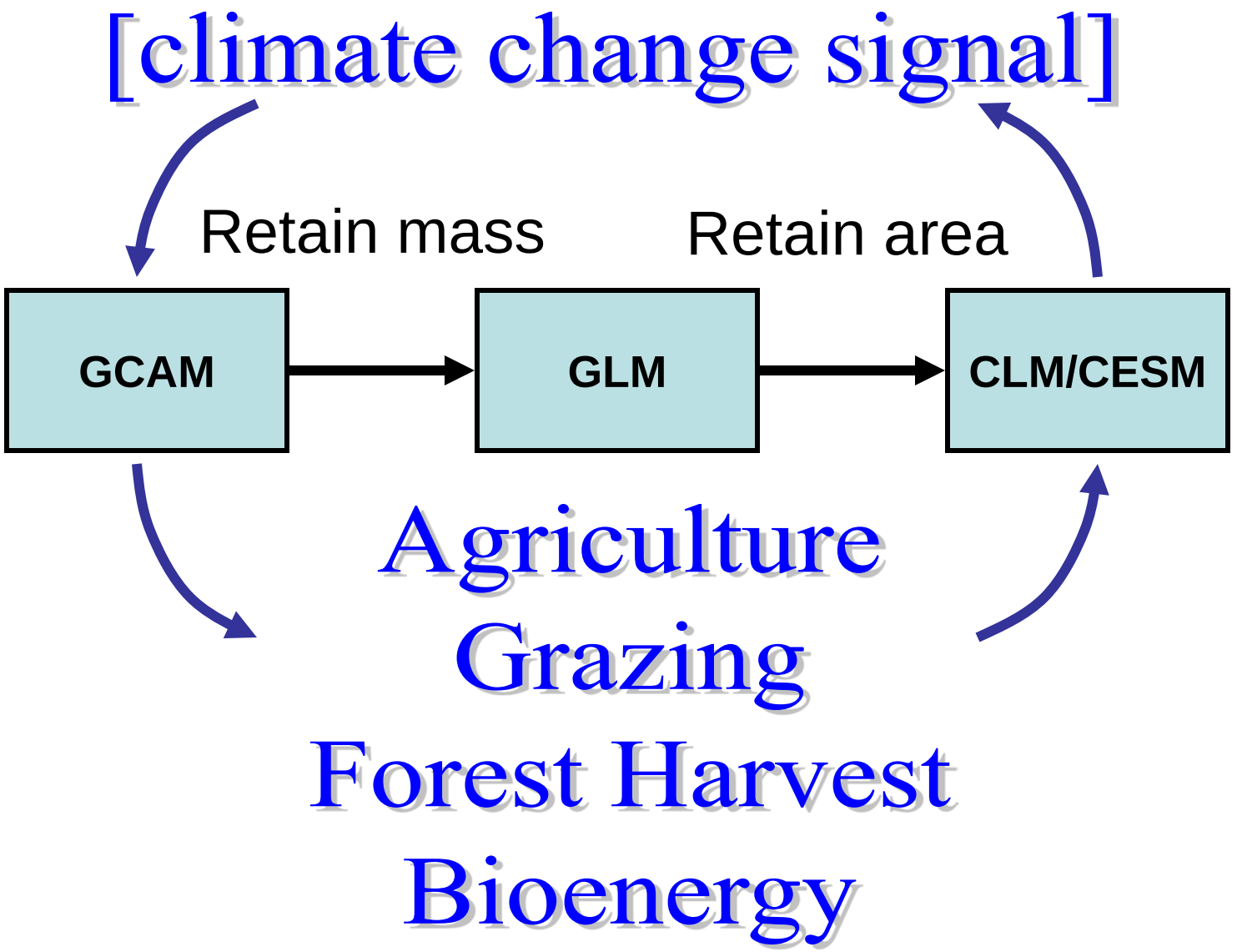
Impact on CESM predictions: C stocks



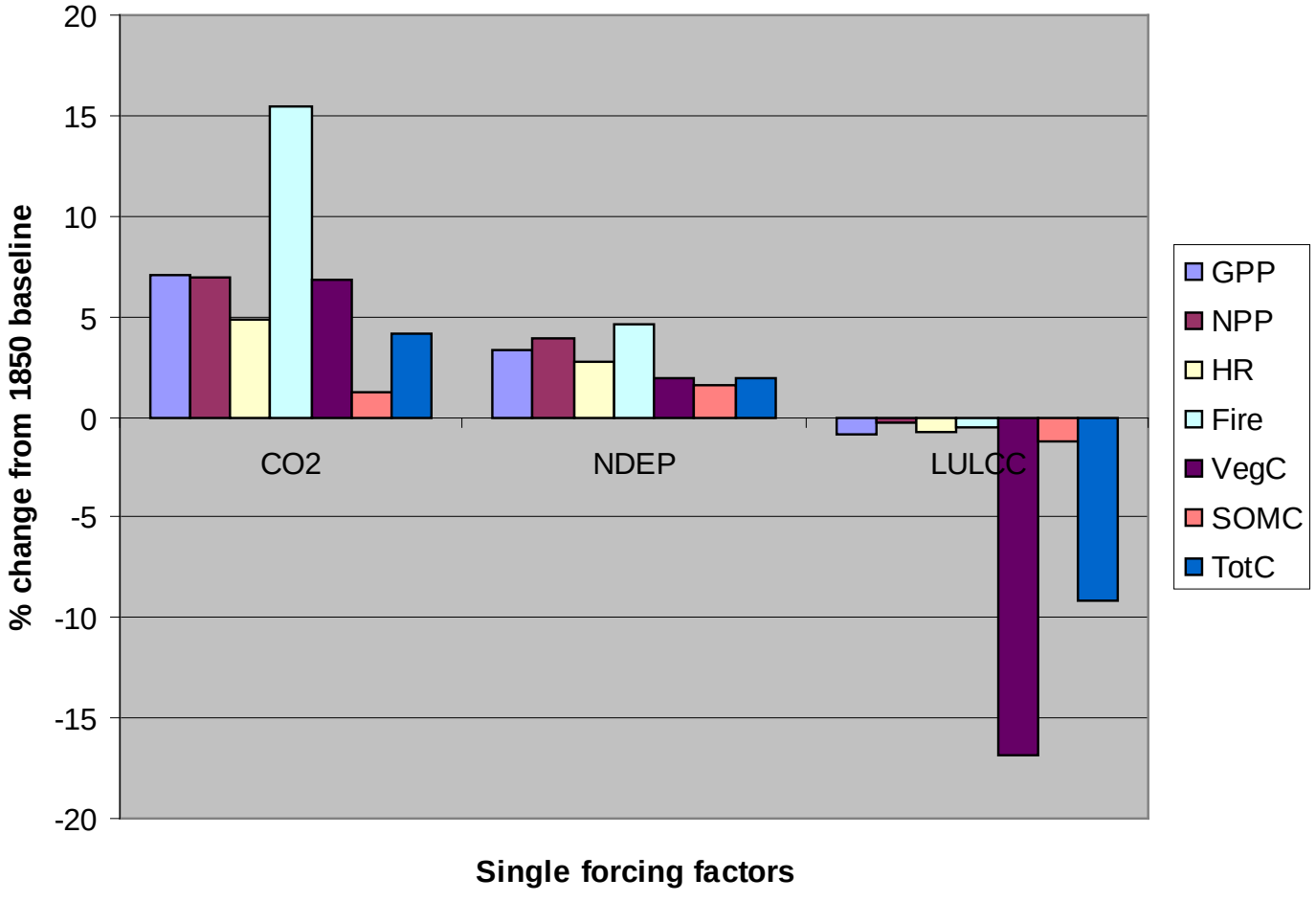


Higher crop yields in GCAM lead to less deforestation, **higher C stocks on land**, and **lower atmospheric CO_2**

Integrated coupling strategy

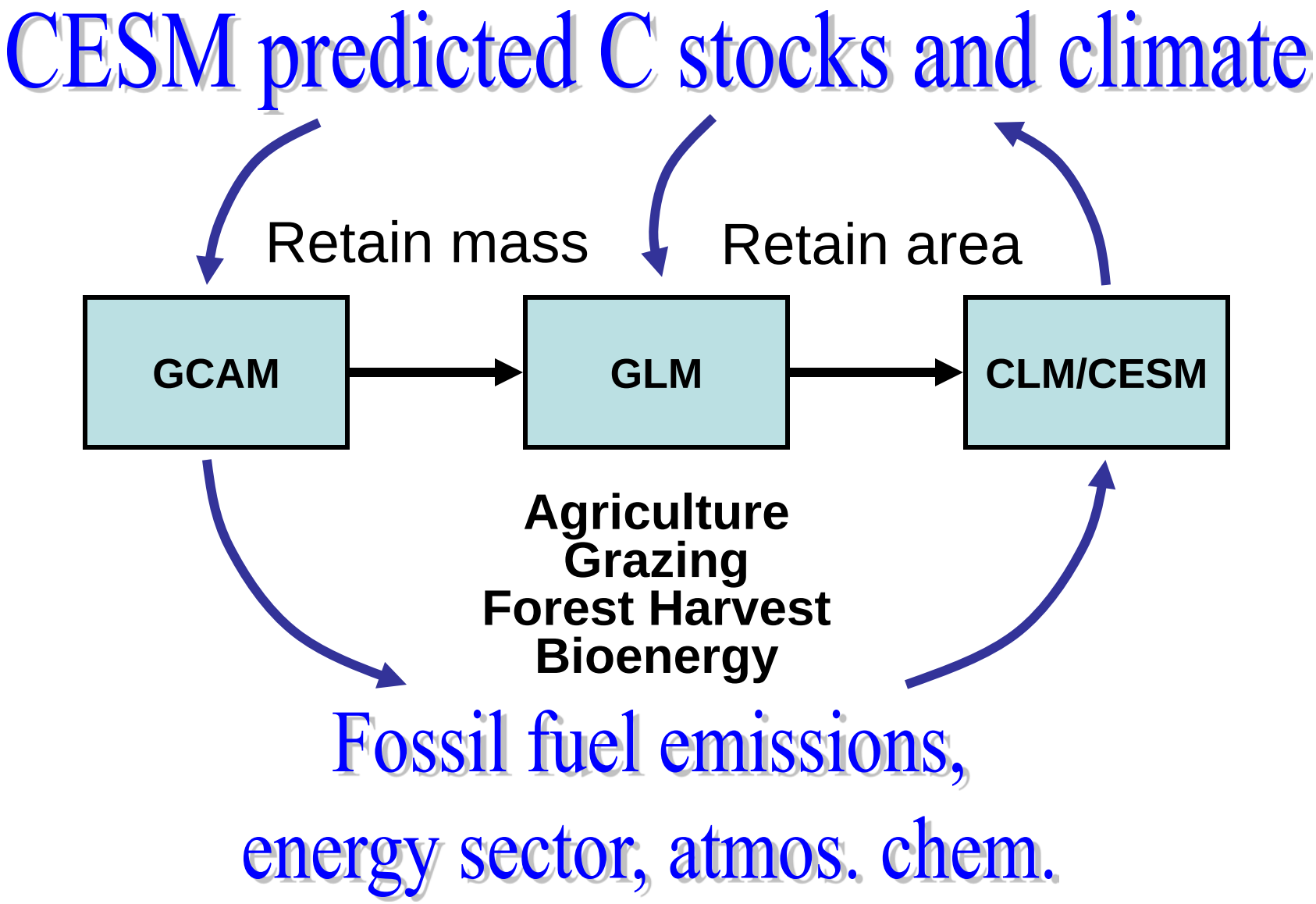


Evaluating multiple formulations for the CLM – to – GCAM climate signal



C-flux is less affected than C-stock by the (unwanted) effects of landcover change

Integrated coupling strategy: next steps



Integrated coupling strategy: next steps