RCP4.5 Update

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Joint Global Change Research Institute
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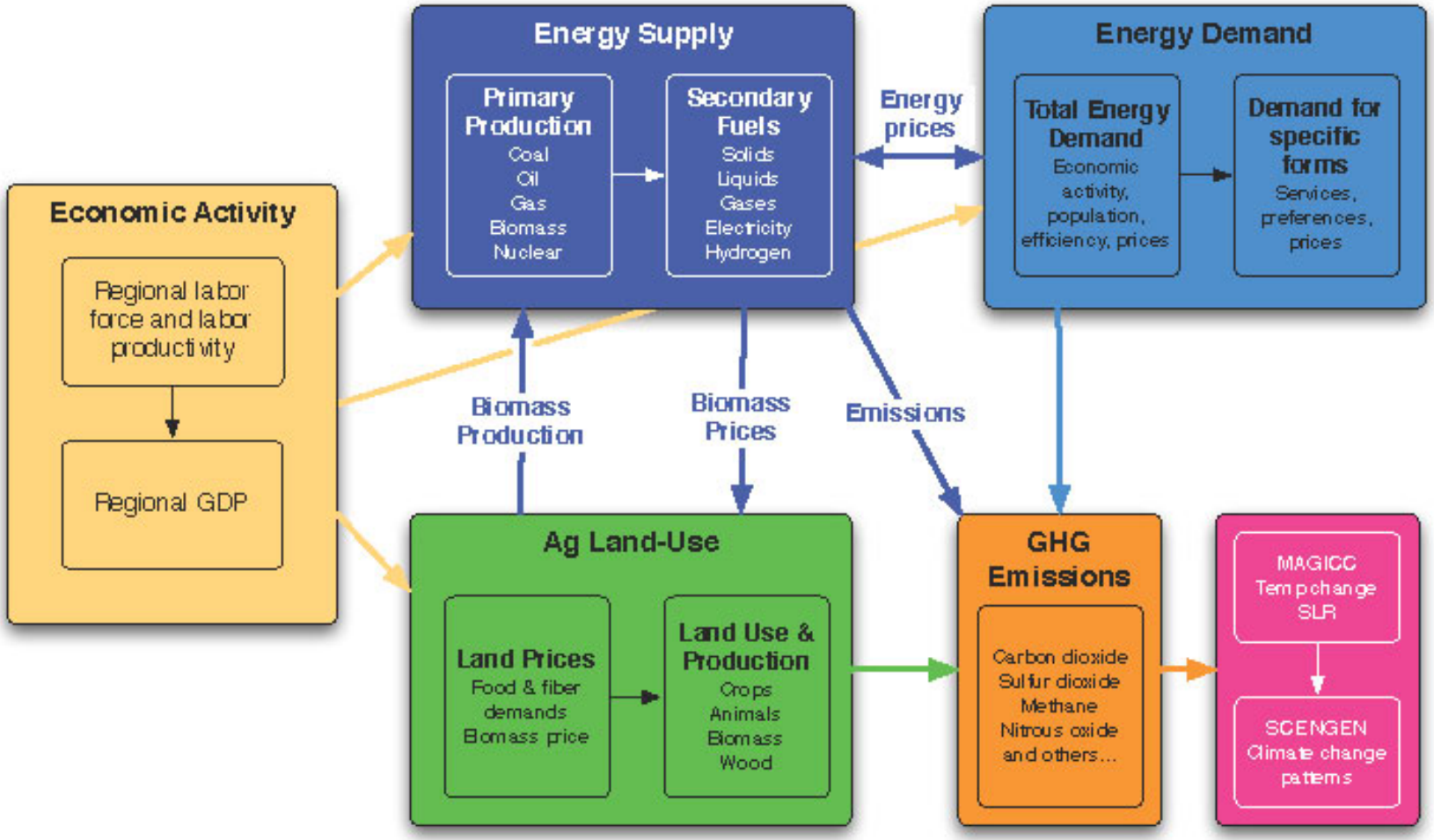
GCAM (formerly MiniCAM) Structure



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Initial basis for RCP4.5

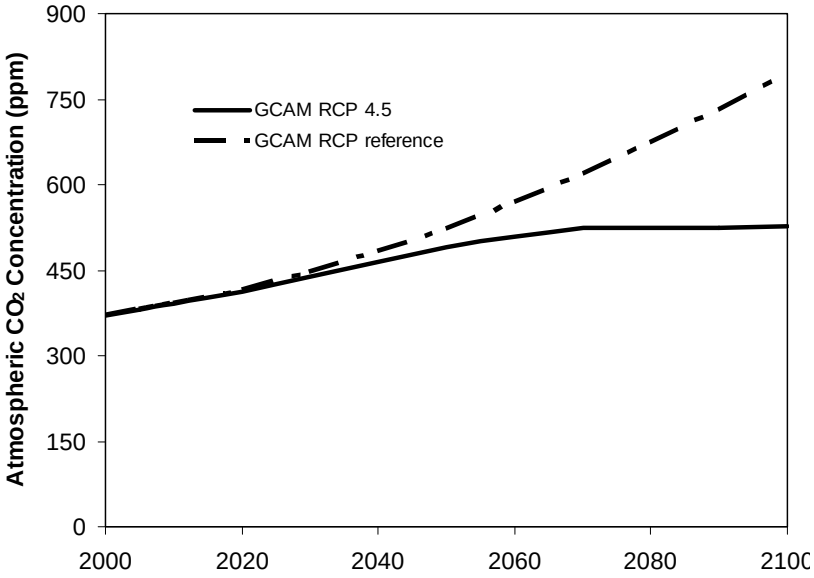
- US Climate Change Science Program scenarios published in 2007.
  - Population peaks at 9 billion in 2065 and declines to 8.7 billion in 2100
  - Global GDP grows by an order of magnitude by 2100
  - Energy consumption triples by 2100
  - Carbon price of $500 per ton C by 2100
  - Net negative emissions from electric power generation
  - Renewables, nuclear and CCS all deployed
  - Mechanism for valuing terrestrial carbon included

- Reference: Clarke, L, J Edmonds, H Jacoby, H Pitcher, J Reilly, R Richels. 2007. Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations. Sub-report 2.1A of Synthesis and Assessment Product 2.1 by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Department of Energy, Office of Biological & Environmental Research, Washington, 7 DC., USA, 154 pp.

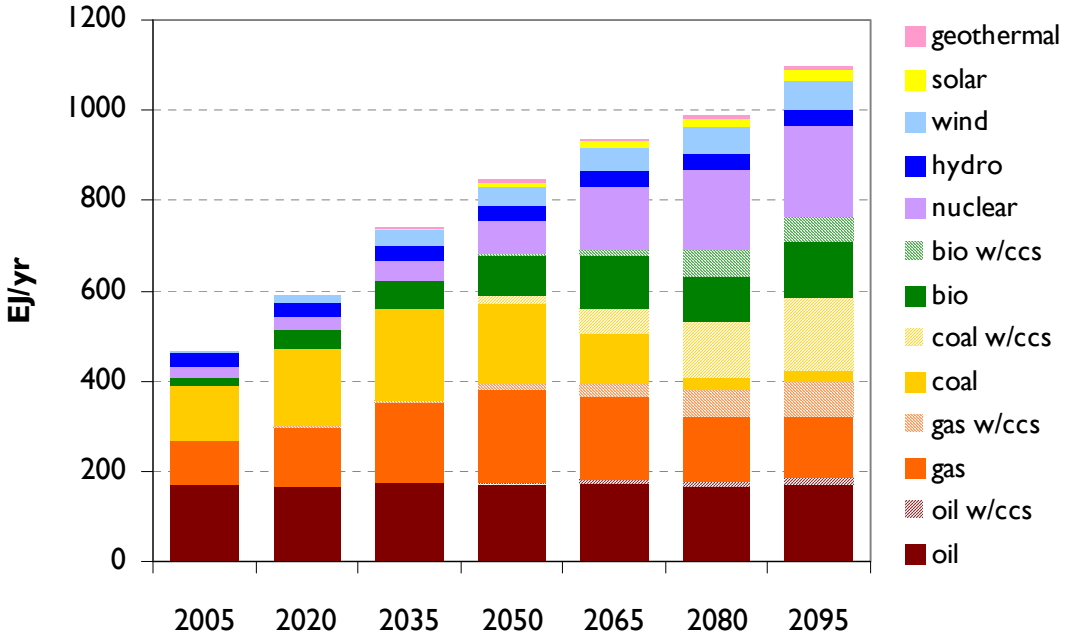
Modifications for the RCP4.5

- Scenario drivers and core model assumptions remain the same
- RCP4.5 was run with an updated version of GCAM:
  - Agriculture, Land Use and NonCO_2 greenhouse gas components updated and fully integrated in O^{bj}ECTS GCAM
  - Updated base year land use and emissions inventories to harmonized RCP data
  - Modified mechanism for valuing terrestrial carbon equally to fossil fuel and industrial carbon
  - Updated version of MAGICC to be consistent with other RCP modeling groups.

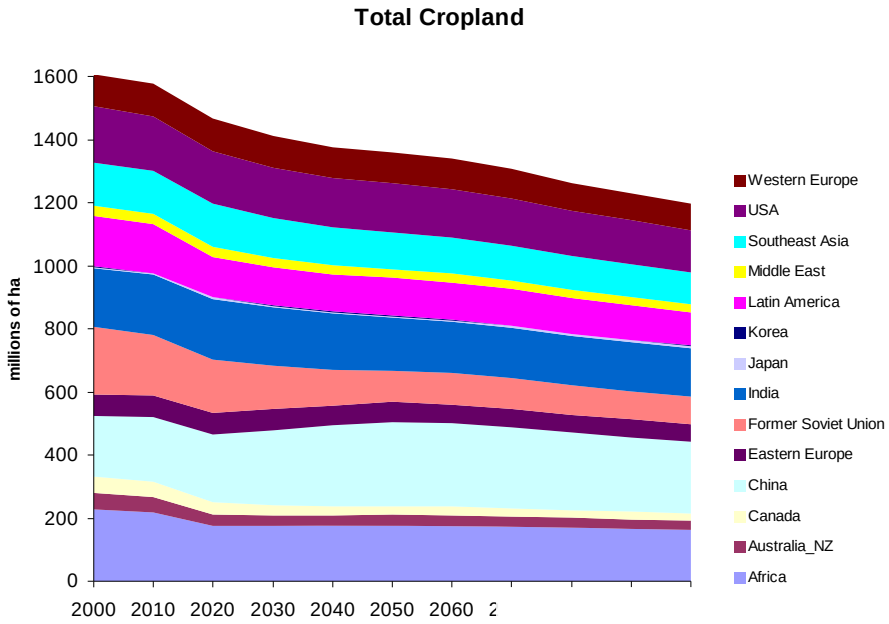
Results



CO_2 concentration



Primary Energy Consumption

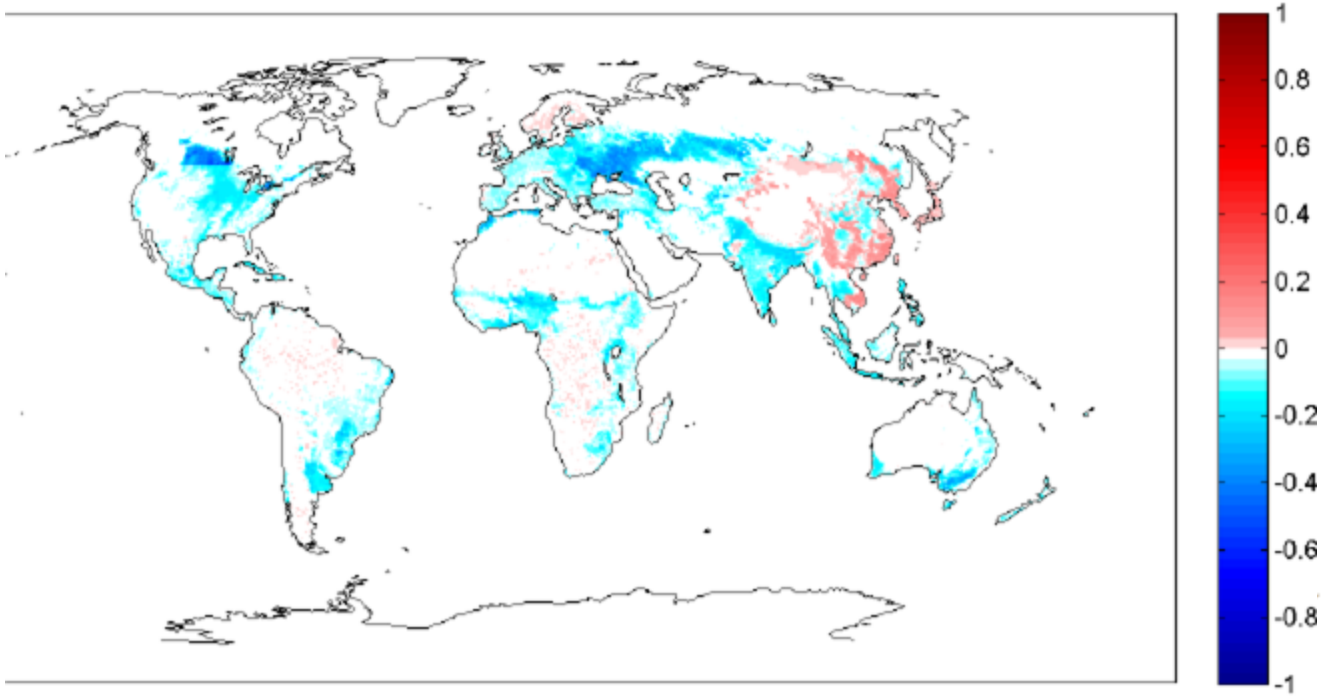


Terrestrial carbon valuation

- Reduce LUC emissions by expansion and preservation of forests
- Decline in cropland area

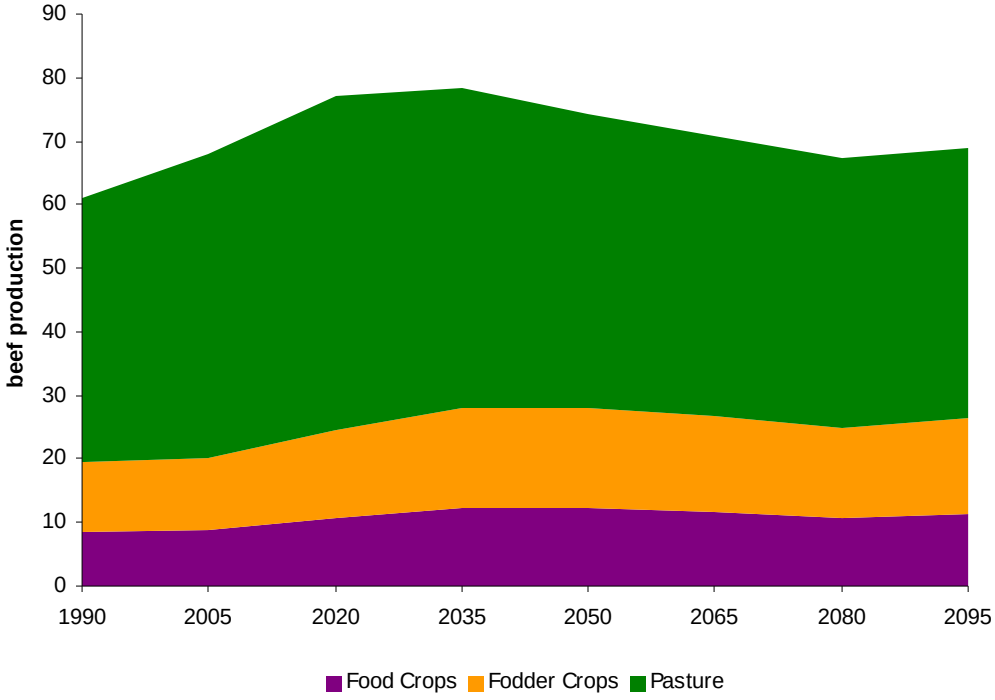
Land Use

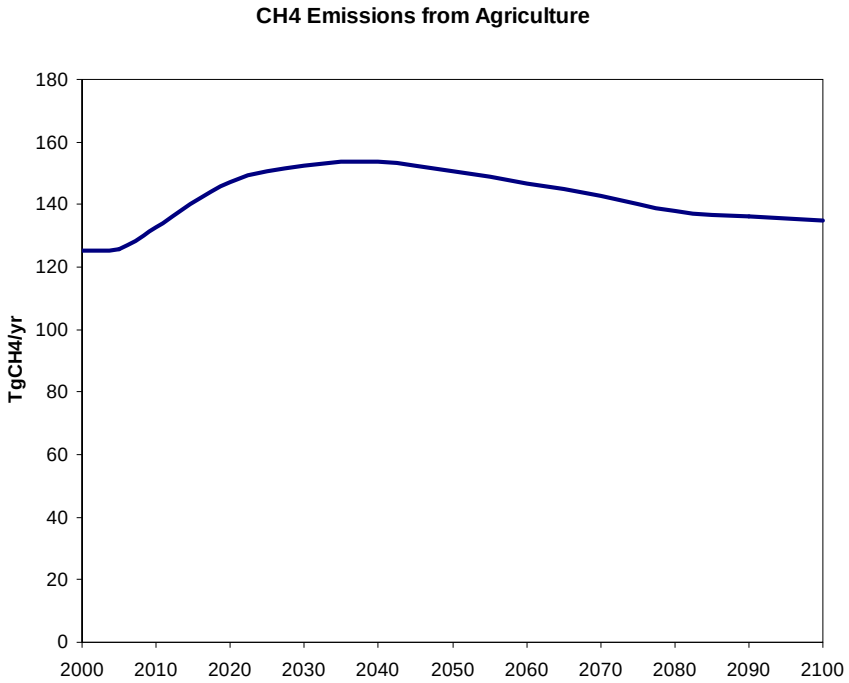
Downscaled for harmonization



Beef production

Feed for beef shifts into dedicated crops





Overall production declines, causing declining emissions

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Updates since the data release in May

- Model name – from MiniCAM to GCAM
- Updates and corrections to emissions
  - BC/OC inventory update and re-release in July
  - Additional correction to shipping grids in September
- Climate model implementation – land use
  - Initial interpretation of land use by CM groups revealed some larger questions about the harmonization and hand-off steps.
- Land use downscaling algorithms updated and new products due to be released in a few weeks.
- Extension to 2300 – remain stabilized at 4.5.

Future research directions

- Continue working with UNH and refining LU downscaling algorithms for GCAM to be consistent with scenario assumptions
  - Implications for harmonization algorithms?
- Comparison of non-CO_2 GHG emissions across RCP models
- Development of storylines and communication with users in CM and IAV communities
  - UNH and CM groups meeting this week
- Continued improvements to the model